

The Mining Journal

London, November 29, 1957

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Vol. 249

No. 6380

Established 1835

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Published each Friday by

THE MINING JOURNAL LTD.

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LONDON, E.C.2.

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Telephone

MONarch 2567 (3 lines)

Annual Subscription £2 10s. Single copy ninepence

Rum Jungle Unveiled

FOR the first time figures and details of uranium production are given by the Australian Atomic Energy Commission in the most informative report it has so far published. This has, of course, been made possible by the withdrawal of restrictions on the publication of a good deal of atomic energy information by agreement with the U.K., U.S. and Canada.

In tabling the report the Minister for National Development recalled the circumstances under which Rum Jungle began. Under the pressure of defence needs, time was the essence of the contract and the undertaking was launched before the operational programme had been worked out in full detail. Naturally, there were many initial difficulties in getting the plant and the mine into smooth operation, but progress has, nevertheless, been satisfactory.

During 1956-57 Rum Jungle's monthly output generally exceeded budget estimates, and over the whole year output of uranium oxide exceeded both the budget estimate and the rated capacity of the plant. In the first months of the financial year, 1957-58, production has been running at some 10 per cent higher than the target set in the operating budget. The percentage recovery of uranium oxide in the treatment plant has risen to 90 per cent, which is as high as is normally obtained from this type of plant.

Uranium and uranium-copper ore treated at Rum Jungle increased from 50,720 tons in 1955-56 to 71,628 tons in 1957-58 and the uranium content of the treated ore from 8.4 to 9.1 lb. per ton. In the latter year production comprised 541,652 lb. of uranium concentrates and 1,406 tons of copper in concentrate against 333,546 lb. and 658 tons respectively in 1955-56.

Open-cut mining of White's deposit (the major orebody at present being worked at Rum Jungle) continued satisfactorily in 1956-57, enough ore being mined during the dry season to supply the plant for the whole year. Ore reserves at the end of the year comprised 197,000 tons of uranium ore (6 lb. contained uranium per ton), 138,000 tons of uranium-copper ore (6.7 lb. per ton uranium content and 3.9 per cent copper content), and 286,000 tons of copper ore (2.8 per cent copper). These reserves are adequate to complete the contract for the supply of uranium oxide to the Combined Development Agency, but exploration work is being energetically carried on. Mining companies are also sending in ore to Rum Jungle for treatment.

The Commission notes a substantial reduction in the activities of prospecting and mining companies and of individual prospectors searching for uranium. Formerly eighteen companies were active in this field, but now only five companies and a few syndicates are exclusively occupied with uranium, four of the companies being engaged in the Northern Territory and one in Queensland. The chief areas of interest in the Northern Territory were the South Alligator River and Calvert Hills. In Queensland the only large-scale activity was at Mary Kathleen.

In the Calvert Hills and adjoining areas in the Gulf country, near the Queensland border, two mining companies are developing uranium discoveries. Work on these prospects is proceeding on an extensive scale. Other uranium development work is taking place

near Broken Hill, New South Wales, and in the Rossarden district of Tasmania.

Considerable progress has been made in bringing into production uranium from the Mary Kathleen deposit near Mount Isa in Queensland. Mary Kathleen Uranium Ltd. is under contract to supply uranium oxide to the U.K. Atomic Energy Authority, which is providing part of the capital for the undertaking. Open-cut mining has begun and the ore from these operations is being stockpiled. The treatment plant is under construction and is expected to be in operation by 1959, as originally estimated.

Australasian Oil Exploration, which holds a 35 per cent interest in Mary Kathleen Uranium in the Mount Isa-Cloncurry district, has entered into an agreement with Stanleigh Uranium Corporation of Toronto, for the working of the Anderson lode, near Mount Isa. This lode was the first large uranium occurrence located in North Queensland, and was discovered by the vendor company, Australasian Oil. It has been drilled to a depth between 400 ft. and 500 ft. and is from 14 to 98 ft. wide. Results of prospecting work by trenching and diamond drilling have indicated some 300,000 tons of uranium-bearing material, the grade being from 0.2 to 0.25 per cent uranium oxide. The occurrence is likely to present some metallurgical difficulty, for the uranium mineral is of very small grain size, and fine grinding for liberation, or exposure of the uranium mineral, will be a basic problem in preparation for treatment. The discovery of this lode was followed almost immediately by the finding of the immense Mary Kathleen occurrence, the great potential importance of which overshadowed the first discovery and its problems.

This year an approach was made to the Combined Development Agency with a view to negotiating an arrangement for the purchase of ore from mining companies in the South Alligator River area. Having regard to its other commitments, the Agency was unable to agree to the Commonwealth's proposals, but further negotiations are in progress for the disposal of the South Alligator production. In the event of their successful completion, the government has agreed to build an all-weather road into the area, thus enabling South Alligator ore to be taken to Rum Jungle for treatment.

In this connection our Australian Correspondent reports that there is likely to be a new aspect in uranium mining in the Northern Territory. One of the large exploratory companies, United Uranium N.L., operating on the South Alligator field, has for some time, being weighing the possibilities of erecting its own plant for the production of uranium oxide, but hitherto it has been considered that the ore reserve position and prospect has been unfavourable to incurring the capital cost of the necessary plant. It was, therefore, decided to send United Uranium ore to the government-owned plant at Rum Jungle. Following investigations overseas, this decision has been reversed, for it is intended to use a new solvent extraction process which is in successful use in the United States, the capital cost of which will be low. It is now planned to erect a plant to produce uranium oxide, with a capacity of 30,000 tons of ore per year, and it is considered that the quantity of ore developed in the El Sharana property and in other mines on the field is sufficient to justify such a plant. The company has until December 31, to take advantage of a contract negotiated with the British Atomic Energy Commission for the purchase of uranium ore from the South Alligator River area, on attractive terms and for a long period. The position will be helped by the discovery in diamond drilling at Coronation Hill of a new orebody, the drill intersection showing 38 ft. of lode worth 6 lb. uranium oxide per ton. The company's Rockhole deposit has been proved in three sections, giving a length of 563 ft. with a

workable value of 1.0 per cent uranium oxide over a width of 3 ft.

For some years the output of Australia's two main producers—Rum Jungle and the Radium Hill mine with its treatment plant at Port Pirie—is committed to the Combined Development Agency for defence purposes. When the Mary Kathleen undertaking comes into production in 1959, the total Australian output will be about 1,000 tons of uranium oxide a year.

While this is regarded as a satisfactory outcome of past prospecting and development, the Commission is concerned that the present scale of activity is not greater. Large areas of Australia are geologically favourable to the occurrence of uranium, but only a fraction of these have been investigated with any thoroughness. Australia's immediate requirements are adequately provided for, but with an increasing domestic power programme and, over the long-term, an increasing world demand, a steady flow of new discoveries is regarded as desirable. It is feared that too slow a rate of exploration at this stage could prove a serious handicap to development later.

MINING PROGRESS IN THE U.S.S.R.

Some observations on the progress and prospects of Russia's mining industries were made by Mr. Nikita Krushchev in his speech at the Jubilee session of the Supreme Soviet.

During the past 40 years many new deposits of all kinds of valuable minerals have been discovered and explored. The Soviet Union now claims to stand first in the world in prospected deposits of vital mineral raw materials, including iron and manganese ores, coal, copper, bauxites, nickel, tungsten, lead, mercury, mica, zinc and potassium salts, and also to be one of the leading countries in the world for known petroleum deposits.

In the remote regions of the Far East, Siberia and the North-East—undeveloped and uninhabited in Tsarist days—the numerous minerals discovered since the Revolution include large deposits of tin, molybdenum, iron, coal and magnesite. In the Yakut Autonomous Republic, huge deposits of coking coal have been found, as well as diamond fields (claimed to be extremely rich), iron ore, gold, tin and other minerals. Extensive reserves of petroleum are being widely exploited in the vast expanses between the Volga and the Urals.

The central parts of the U.S.S.R. are expected to have ample opportunities for development as a result of the opening up of immense deposits of iron ore in the region of the Kursk magnetic anomaly.

Very large natural resources also exist in the Southern Ukraine, which is one of Russia's leading producers of iron and manganese ores. The borders of the known ore basins have been considerably extended and new deposits of various valuable ores have been discovered. New coal basins—the Dnieper and Lvov Volhynia, which together with the Donbas will steadily increase the output of coal, have been discovered and explored.

Mineral discoveries in Kazakhstan include vast deposits of iron ore, coal, chromites, high quality bauxites, "all sorts of ferrous and non-ferrous rare metals", and many other mineral raw materials. At present, nearly half the prospected deposits of copper, lead, zinc and tungsten in the U.S.S.R., and more than one-fifth of the country's reserves of molybdenum, are concentrated in this area. Central Asia is rich in coal, petroleum, copper, lead, antimony, mercury, tungsten and other minerals.

This year, said Mr. Khrushchev, the U.S.S.R. will produce approximately 84,000,000 tons of iron ore, 462,000,000 tons of coal (including 395,000,000 tons of hard coal), 98,000,000 tons of petroleum, more than 37,000,000 tons of pig iron, 51,000,000 tons steel and 210,000,000,000 kWh. electric power. Preliminary figures indicate that in approximately fifteen years annual output of these commodities will reach 300,000,000-350,000,000 tons of iron ore, 650,000,000-750,000,000 tons of coal, 350,000,000-400,000,000 tons of petroleum, 75,000,000-85,000,000 tons of pig iron, 100,000,000-120,000,000 tons of steel and 800,000,000,000 900,000,000,000 kWh. of electricity.

From Mr. Khrushchev's speech it is quite clear that in its plans for the further expansion of the mining industry the U.S.S.R. seeks not merely to overtake but even to outstrip the West.

U.S. AID SPENT IN BRITAIN

The International Co-operation Administration is the agency through which the United States Government administers its foreign aid programmes. With the exception of agricultural commodities which are in surplus in the United States, the agency normally adopts a policy of world-wide procurement in respect of the materials which it furnishes to other countries, and its latest Operations Report, covering the financial year ended June 30, 1957, shows that the sum of \$44,665,000 was spent in the United Kingdom.

The statistics are divided between project expenditures, where I.C.A. plans the execution of a complete project, and non-project expenditures, which normally involve merely the supply of goods. Although the tendency is now to devote a growing proportion of I.C.A. funds to specific projects, the *Board of Trade Journal* points out that it is still the non-project expenditure which covers most of the purchases.

Total non-project expenditures were just over \$1,000,000,000, of which \$604,000,000 (over \$350,000,000 for agricultural commodities) was spent in the United States. Of the balance, consisting almost entirely of non-agricultural commodities, \$36,000,000 was spent in the United Kingdom, but substantially larger amounts went to other countries — \$135,000,000 to Japan, \$54,000,000 to Germany and \$52,000,000 to France. Of the British share, the most important groups were chemicals and related products with \$5,000,000, iron and steel mill products with \$3,000,000, raw materials and semi-finished products with \$5,000,000, machinery and equipment with \$11,000,000, as well as motor vehicles, engines and parts with \$5,000,000.

Total project expenditures were \$174,000,000, of which \$161,000,000 were spent on commodities. Of the commodity expenditure, \$104,000,000 was spent in the United States, \$19,000,000 in Japan, \$12,000,000 in Germany, and \$9,000,000 in the United Kingdom. Of the British share, the most important groups were iron and steel mill products \$1,000,000, machinery and equipment \$2,000,000, freight cars \$2,000,000, and finally electric locomotives \$2,000,000.

While the proportion of I.C.A. funds spent in Britain is extremely small—a matter of 4.4 per cent—there is presumably no reason why the U.K. should not increase its present share. The U.S. itself, for obvious reasons, will always be I.C.A.'s major source of supply, but the substantial sums spent in Japan and Germany indicate the probability that considerable scope exists for expanding Britain's share of the agency's expenditures, which appear to be potentially a valuable source of dollar earnings. It

is noteworthy that I.C.A. procurements include large quantities of mining machinery and equipment, iron and steel, and non-ferrous metals and alloys.

For information on intended purchases financed by I.C.A., firms should rely in the first instance on their local representatives in the countries concerned. When there is sufficient time before the closing date for bids, information is also published in the *Board of Trade Journal* and through the Special Register Service. The Export Services Branch, Board of Trade, Lacon House, Theobalds Road, London, W.C.1 (Telephone: Chancery 4411, Ext. 359), will also be glad to assist manufacturers in respect of particular aspects of I.C.A. procurement. For the benefit of firms which might be interested in tendering for I.C.A. business, attention is drawn to appropriate procurements in our own "Mining Miscellany" feature.

PROGRESS OF THE NEYVELI SCHEME

Work on the Neyveli Lignite Project in Madras State has been reported as progressing satisfactorily.

Earth moving operations with conventional equipment started in the middle of this year and so far approximately 1,200,000 cu. yd. of overburden have been removed.

Specialized mining machinery will start arriving from the middle of 1958 and the first small continuous bucket wheel excavator, after erection at site, is expected to go into operation in January, 1959. One more small, and two large bucket wheel excavators will follow, and when they begin operations the conventional earth moving equipment which cannot operate efficiently at great depths, will be gradually withdrawn. Meanwhile, the conveyor system for the transport of lignite to the production units will arrive, and it will be utilized to transport the overburden excavated from the first mine cut.

On the basis of the results of the large-scale pumping tests completed last year, the definite system for ground water control has been drawn up as an integral part of the mining scheme. In order to secure the necessary reduction in ground water pressure for mining operations to proceed in safety, it has been estimated that some 48,000 gals. of water per minute will have to be pumped from the artesian aquifers.

The lignite seam in the first cut is expected to be exposed in 1960, and by the end of that year the quantity required for the first unit of the thermal station will become steadily available. The first production stage of the mine will be reached in 1961.

JAPANESE COAL STRIKE ENDS

After striking for over three months, the 4,600 miners at the Kishima Colliery in Southern Japan, have returned to work. The strike began in early August when the workers came out in support of their claims for increased wages, shorter hours and more liberal labour contracts. A considerable part of Japan's present labour unrest can be traced to the strike. Many unions incorporated in the General Council of Japanese Trade Unions to which the Kishima workers are affiliated have held sympathy strikes in support of the miners' demands.

In speaking of the ending of the strike a management spokesman said both sides had agreed to the payment of special allowances prior to a final solution. A combined committee of men and management is to work out final details concerning monthly wage increases and modified labour contracts.



Alongside: Preparations for multiple borehole trial at Newman Spinney, showing airtubes loaded into boreholes

Below: Exit from horizontal borehole in coal seam showing the reaming out of the hole.

FOR some eighty years it has been recognized that in certain circumstances the gasification of coal *in situ* offers a very attractive alternative to conventional mining followed by normal coal gasification in a surface plant. In both cases the end product is the same—gaseous thermal potential—but with the former method much of the dead work in the conversion of solid fuel to gaseous is eliminated.

In Britain gasification trials began in 1949 and the results were summarized in a H.M.S.O. publication "*British Trials in Underground Gasification, 1949-55*". By this time some £750,000 had been spent and over 5,000 tons of coal gasified by a variety of means. The report concluded that one or more methods of gasification were practicable and offered prospects of success.

Accordingly, in March this year, Humphreys and Glasgow Ltd., moved in on the scene of many of the preliminary trials—Newman Spinney near Chesterfield, Derbyshire—and undertook to have a pilot power plant capable of generating 5 MW. of electricity in operation by the end of 1958. This is approximately equivalent to a rate of burning of 150-160 tons of gas per day. With an output of 5 MW. this represents only about one-tenth of the size of a minimum commercial system and the function of the plant to be started up next year is purely to demonstrate the process and probable costs, on a larger scale than in the preliminary trials, and to provide further technical information to aid in the design of projected full-scale 50-100 MW. systems.

By **ALLAN GRIERSON**

The pilot plant at Newman Spinney is being designed on the basis of the blind borehole technique. Essentially this involves drilling holes some 12 in. in dia. and 100 yds. in length within the seam of coal to be gasified. Along the entire length of this large borehole is laid a 4 in. dia. chrome steel tube having specially sealed joints. At the innermost end of the borehole is placed a flame initiation capable of being ignited remotely via detonator and leads. After flame initiation, propane is passed through the inner tube for some twelve hours after which the coal will continue to burn if fed with the requisite amount of air. Obviously the right balance between the rate of air feed, and rate of burning has to be obtained. Strict temperature control is necessary and all these factors vary according to type of seam being gasified. In general, however, some eight pounds of air are supplied per-pound of coal gasified, the temperature at the fire seat being in the region of 1,000 deg. C. A normal borehole under these conditions will burn some 3 to 4 tons per 24 hours yielding a gas having a calorific value of 75 to 85 B.Th.U.'s per cu. ft. A

typical analysis of such a gas as obtained in preliminary tests is as shown.

CO ₂	O ₂	C _n H _m	CO	H ₂	CH ₄	N ₂
12.8	0.4	0.4	9.1	9.9	1.6	65.8

During the burning of the coal *in situ* the evolved gases pass back down the borehole on the outside of the chrome steel air inlet pipe and thence to the surface.

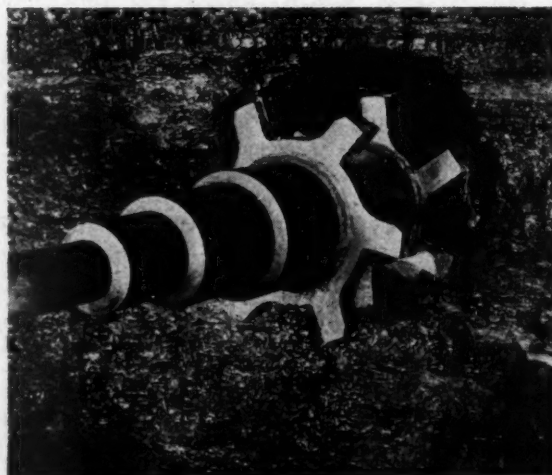
Assuming, say, 55 per cent of the available heat in the coal to reach the surface in gaseous form and the C.V. of this coal to be 11,000 B.Th.U.'s per lb., it follows, that, if the overall thermal efficiency of the pilot power station is 20-25 per cent, a total of some forty such bore-

UNDERGROUND

holes must be in operation simultaneously in order to supply sufficient gas to maintain an output of 5 MW.

Simultaneous borehole operation brings many complications in its train, not the least of which is ensuring uniform load sharing. This can only be achieved if the holes are correctly sited and accurately drilled and the reactions in the several boreholes carefully controlled. Experience in the U.K. suggests that in a seam 3 ft. thick the evolved gases cease to be combustible when the channel of the borehole has enlarged 5 to 10 yds. Over this area no combustible matter is left other than coked coal around the boundaries. This limiting range of effective combustion activity fixes the distance apart of the boreholes.

A survey of the available coal measures at Newman



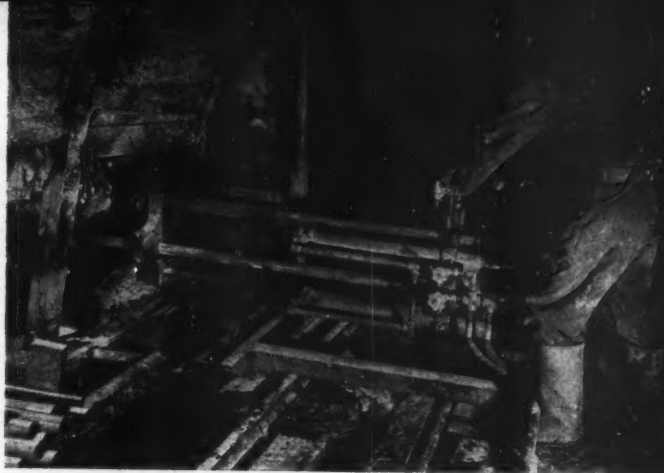
Alongside: Development of directional drilling technique at Oxcroft Colliery, Derbyshire, using Boyle's experimental rig

Below: The headgear of Experimental Shaft 3 at the N.C.B. site at Newman Spinney, near Chesterfield

Spinney was carried out earlier this year by the Opencast Executive of the N.C.B., and on the basis of this survey the positions of the first five pilot plant arrays have been fixed, preliminary surface works have been undertaken and sinking of the first shafts has commenced.

Each of the pilot plant arrays will have a concrete-lined shaft, 8 ft. in dia., going down to the selected coal seam. From this shaft a gallery 100 yds. long and some 7 ft. x 6 ft. 6 in. cross-section will be driven into the coal seam and from either side of this gallery boreholes 100 yds. long will be drilled in the coal seam at 10 yd. intervals.

Thus there will be ten boreholes on each side of the gallery embracing an area of approximately 20,000 sq. yd. of



quired will increase appreciably. With the present arrangement air pressure will be 10 p.s.i. initially.

For the pilot plant, two of the arrays will be used simultaneously, giving a useful life of about nine months. During this period the remaining three arrays will be made ready. This size of these arrays is not, of course, representative of the size contemplated for the powering of a commercial generating plant. With a full-scale power station, longer galleries and boreholes would be used and

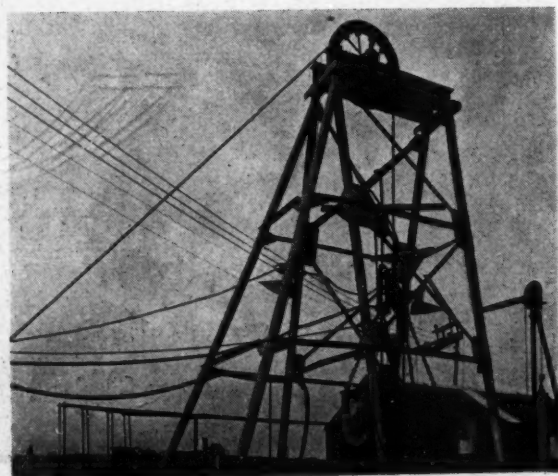
COAL GASIFICATION IN BRITAIN

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coal seam. In the present seam this is approximately equivalent to 20,000 tons of coal. Air will be conducted to the far end of each borehole by the air tubes in the borehole fed via blast mains running down the shafts and gallery from a central blowing plant adjacent to the power station.

At the top of the shaft the air stream will be split and carried by four pipes down the shaft and into the gallery, each pipe serving 5 boreholes. Working on the basis of 160 tons gasified per day the air feed will be approximately 30,000 cu. ft. per hour (S.T.P.) per borehole. This large quantity of air required is one of the criteria governing the size of the air inlet pipe contained in the borehole as, if this latter is made too small, the air ventilating pressure re-

On March 1st this year Messrs. Humphreys and Glasgow Ltd. took over from the National Coal Board an experimental gasification site at Newman Spinney, Derbyshire, and under the terms of the contract were charged with the immediate construction of a pilot scale gasification plant together with further experimental and development work necessary for the preparation of designs for a commercial scale gasification plant. This article is a short account of what has been achieved and what is expected of this ambitious project.



consequently the number of shafts to be sunk would be much less. Shaft sinking constitutes one of the major item costs and in the experimental pilot design some 26 shafts will be used per sq. mile of take compared with half this number when the commercial plant is installed.

So far no multiple borehole experiments have been completed but final preparations are in hand for a four-borehole system to be fired simultaneously. In the case of this experiment the gallery and the shaft will be used to conduct the gas to the surface, the gas from each borehole entering directly into the gallery. Water sprays will be in continual operation in the gallery and the shaft, and will reduce the exit temperature of the gas at the shaft cap to 35 deg. C.

This experiment is designed to give information on the behaviour of multiple boreholes, particularly on controlling air flow to individual holes from a common manifold.

The development of equipment and technique to drill

accurate long distance horizontal or near horizontal boreholes has been one of the major objectives of the recent trials at Newman Spinney. Many different drills have been tried and encouraging results have been obtained with a Boyle's experimental hydraulic rig and a Nüsse and Graefer pneumatic rig. With both types the action is rotary. Initially a pilot hole is put through to the required depth, being normally 2½ in. dia. Then the hole is reamed out to the finished 12 in. dia.

A *sine qua non* of the multiple blind borehole method of underground gasification is that the holes must be drilled true and quickly. By using appropriately designed bits and with controlled thrust and r.p.m. together with specially designed rod assemblies, the accuracy of direction and rate of drilling have greatly increased and overall speeds of 10 ft. per hour are regularly achieved. Several holes have been drilled well in excess of 100 yds. with remarkably little deviation in either plane. The drilling trials are now conducted at nearby Oxcroft Colliery thus leaving the way clear at Newman Spinney for other investigations.

Long-Term Prospects

It is difficult at this stage to be specific regarding the long-term usefulness of underground gasification. The system is ideally suited for those seams which because of various reasons cannot be worked economically by normal mining methods. There are reckoned to be many tens of millions of tons of such coal reserves in the U.K. and the Coal Board is making a survey of these reserves. It must, however, be appreciated that many of these uneconomic seams lie in productive measures and hence adjacent seams will be worked by normal mining methods, so precluding gasification of the interior seam at least until such workings are finished.

Again, much of this interior coal occurs in relatively small pockets. This greatly limits the scope of large-scale plants as because of the low C.V. of the gas produced underground, long distance pipe-line transmission of gas is not feasible. This means that any power plant must be adjacent to the gasification zone, i.e., one plant, one zone. Considering that a 100 MW. station will consume on continuous full load roughly 25 in. acres of coal per 24 hours, it is apparent that to give the power plant a reasonable working life of 20-30 years the tonnage of coal available must be appreciable. Working on the basis of a 3 ft. thick seam, such a station will require one sq. mile of take for every 2½ years' operation at 100 per cent load factor. Higher power station thermal efficiency and an increase in the efficiency of gasification together with a commercial load factor of, say, 50 per cent could possibly increase the life of a sq. mile take to about 6 years. Naturally a smaller area would be required if a greater coal thickness was available.

Whilst the *raison d'être* of underground gasification is to produce electricity and thus augment Britain's fuel supplies it is unlikely that the process will have a marked effect on the national economy. There are too many limiting factors for the widespread introduction of underground gasification. However, the process is not offered as the 100 per cent cure for Britain's chronic fuel ailments, but as an economical means of utilizing an otherwise wasted asset. The process cannot hope to compete with nuclear power on a quantitative basis, although on a cost basis, the cost per therm compares well with that produced by any means. Provisional estimates indicate that the overall cost per therm with a 60 MW. plant will be of the order of 1½d.

Uranium in South Africa, 1946-1956

ALTHOUGH radioactive minerals were detected in the Rand gold ores as early as 1915 the fact had no economic significance until 1944 when it came to light during a literature search in connection with the Manhattan Project. A series of visits to the Rand by American and British scientists during 1944 and 1945 and the taking of underground samples led to the initiation of a testing programme to investigate suitable treatment methods.

Early radiometric techniques, it is now known, gave grade values for the ores tested three times too high, and there is serious doubt whether the deposits would have attracted the urgent interest they did at this time if the correct value of the ores had been fully realized. As it was, laboratory and pilot plant work was undertaken and was considerably stimulated by the eventual agreement of the Combined Development Agency to purchase uranium concentrates at the cost of production plus a margin of profit. The reason this method of payment was selected was that a fixed price attractive to South African producers would have been higher than was being paid elsewhere and might have led to repercussions from the countries concerned.

Uranium in South Africa, 1946-1956 (published by The Associated Scientific and Technical Societies of South Africa, Johannesburg, 1957, in 2 volumes comprising 1,029 pages) records the prodigious efforts necessary to establish the uranium industry on the Rand. It does so in the form of 30 papers presented as a Joint Symposium by the five constituent societies of the Associated Scientific and Technical Societies of South Africa. The papers, all but four of which have appeared in the transactions of the constituent societies during the period late 1955 to June of this year, are now brought together in two well-produced volumes, together with their discussion and a workable index. Security considerations have delayed the relating in detail of this story of South African achievement, but for



Alongside: Part of the reduction plant at President Steyn

Below: The Monarch Shaft head-gear and winder house, West Rand Consolidated, the first shaft in South Africa to be planned solely for uranium ore mining operations



those coming in at the end of the picture, a vast amount of accumulated technical material is now made available, providing a valuable work of reference on the subject.

All aspects of the industry are dealt with by experts in each particular field and amongst the authors' names can be found those of many of the outstanding personalities in the South African mining industry.

In a symposium such as this there is inevitably repetition (there are, for instance, three descriptions of the general geological features of the Witwatersrand in the papers on the mineragraphic and geological studies made of uranium occurrence), and for those who have not shared in the establishment of the industry, as the authors have done, there is lacking a general review of the history and organization of uranium production for which data is abundant in these volumes.

Wealth of Material

Apart from one of the most detailed mineragraphic and mineralogical studies ever made on any ore deposit and a wealth of information on leaching and ion exchange techniques, *Uranium in South Africa, 1946-1956* includes a number of engineering papers underlining the achievements of the mining industry in establishing in six years plants treating 20,000,000 tons of ore a year and consuming vast quantities of chemicals and reagents.

The go-ahead for the first four uranium treatment plants was not given until December 18, 1950, and in the next five years the Transvaal Chamber of Mines was to order £6,000,000 worth of steel and ion exchange resins (mostly from the U.S.A.) in order to meet the demands of the new industry, eventually to consist of 17 treatment plants treating the residues of 29 mines. The West Rand Consolidated plant commenced operations in October, 1952, and despite some dislocation caused by the decision to increase the capacity of three of the original four plants and to add six others to the programme, the Daggafontein and Blyvooruitzicht plants were brought into production in 28 months.

Eventually some £68,000,000 was to be expended in establishing the uranium industry.

Some idea of the scale of the industry can be gained from the raw materials it consumes in producing uranium. It is surprising to find that 21,320 tons per month of MnO_2 (in manganese ore) are used and that whilst manganese recovery sections are incorporated in the majority of the treatment plants which could recover 70 per cent of this manganese, these are not operated. Some 1,500 mono tons

of sulphuric acid are consumed daily and seven Chemico contact acid plants and one Simon-Carves plant have been installed to produce this acid from pyrite. Auto-oxidation techniques were soon abandoned in favour of contact units in conjunction with Dorr fluo-solids roasters, the first application of these machines to pyrite-roasting in the world. In addition to these reagents the industry consumes monthly over 23,000 tons of lime and nearly 500 tons of glue used as an aid to filtration. The transport of these materials by road and rail must, in itself, constitute a serious problem for the industry.

By 1955 the industry was consuming some 60,000,000 units of electricity a month and in anticipation of this demand, construction of a 180 MW. power station had been commenced in 1951 and half its capacity earmarked for the uranium industry.

Problems of maintenance in the highly corrosive conditions experienced in uranium plants are dealt with in two papers and it is interesting to note that after the initial import of stainless steel, valued at £1,500,000, local industries were stimulated to enter this field. This is but one example of the many indirect benefits conferred on the South African economy by the uranium production programme.

Joint production schemes whereby central treatment plants process residues from two or more mines are a feature of the South African uranium industry, which has five such schemes. Some of the difficulties peculiar to joint production projects are discussed in two papers, one of which describes a pumping scheme in the Klerksdorp area where over 21 miles of 6 in. and 9 in. pipe are used to convey 88,000 tons per month of gold slime residues to the Stilfontein treatment plant.

An Established Industry

The South African uranium industry is now fully equipped to fulfil its quota production for the Combined Development Agency and at the expiry of the ten years contracts will be able to enter into a normal competitive market for uranium with amortized plant and a great deal of experience. South Africa has become atom-conscious and, despite her resources of cheap coal, is formulating plans for an atomic power station.

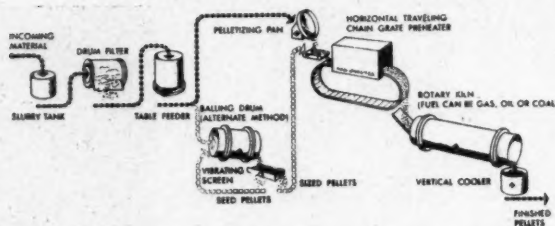
The technology of uranium production is still in its infancy and there will undoubtedly be many significant changes in extraction processes in the future. Meanwhile, *Uranium in South Africa, 1946-1956* provides a wealth of data on existing methods and a permanent record of the achievements of ten momentous years in South Africa.

ALLIS-CHALMERS has announced development of a new process for pelletizing and heat-treating magnetic concentrates produced from low-grade iron ore of almost unlimited availability, to produce extremely hard, durable pellets ideally suited for blast furnace feed.

The process is expected to hasten development of U.S. taconite resources since it offers the steel and ore mining industries important new economies in fuel and maintenance costs, and virtual elimination of pellet breakage.

Magnetic taconite ore (magnetite) must be crushed to a fine powder, so that the iron oxides can be separated from impurities in the process of beneficiation. Because this powdered ore would be blown out of the blast furnace by the normal draft necessary for operation, a number of methods for agglomerating and treating finely powdered ore have been developed. Each method developed to date, however, has involved one or more limitations in terms of high equipment, fuel, or maintenance costs or excessive dust and pellet breakage.

Essentially, the new process consists of four steps: forming the pellets in a balling pan or drum, drying the pellets



Heat treating is completed in the rotary kiln, where highly heated gases complete the development of the network of haematite crystals within each pellet. Temperatures in the kiln must range from about 2,350 deg. F. to not higher than 2,450 deg. F. to assure development of optimum pellet strength. The pellets are then cooled to recover the sensible heat. The small amount of dust and fines which are airborne in the kiln are carried along with the hot kiln gas and filtered out efficiently as the gas passes through the bed of pellets on the grate. The product from this burning process is a superior pellet of haematite which, when subjected to an established ASTM, two lifter bar-drum tumbling test, produces virtually no broken pellets

Heat Treating Iron Ore Concentrates

on a moving grate, heating (partially oxidizing) the pellets on a moving grate, and final burning of the pellets in a short rotary kiln.

The process begins with the forming of $\frac{1}{4}$ - to $\frac{1}{2}$ -in. dia. pellets from the finely ground moist magnetite concentrates. The pellets are conveyed to a travelling grate enclosed in a furnace which is divided into a drying chamber and a pre-heating chamber.

The pellets first enter the drying chamber, where they are subjected to a downdraft of hot gases which have been exhausted from the pre-heat chamber at 600 to 800 deg. F. After driving off the moisture from the pellets, these gases are exhausted to atmosphere at 250 deg. to 350 deg. F.

The grate continues moving the pellets to the pre-heat chamber, where a downdraft of hot (1,750 deg. F. to 1,850 deg. F.) highly-oxidizing gases from the rotary kiln initiate the conversion from magnetite to haematite.

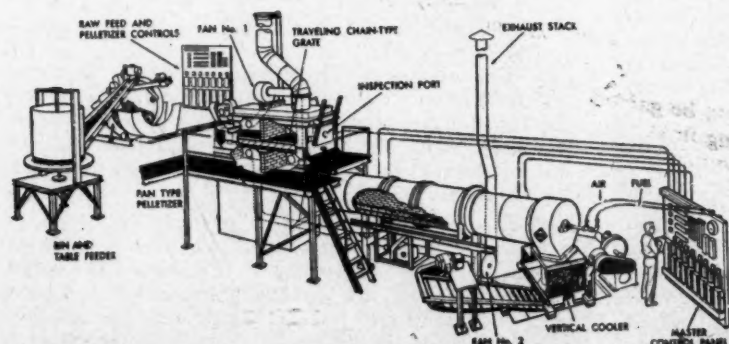
During this oxidation reaction, individual grains of transformed haematite bridge together by grain growth and recrystallization in a solid state to start formation of a mineral structure within the pellet. This transformation ($4\text{Fe}_3\text{O}_4 + \text{O}_2 \rightarrow 6\text{Fe}_2\text{O}_3$) develops sufficient crushing strength (100 to 200 lb.) to withstand the tumbling action of the kiln. Bridging between the individual pellets does not occur due to the small area of surface contact.

and only from 1 to 5 per cent fines (minus 28-mesh). The product is substantially harder than that obtainable from other processes, based on published data.

Fuel economy of the new system is a result of efficient re-use of exhaust gases from one stage of the process to support reactions in others. Kiln exit gases of approximately 1,800 deg. F. are used in the pre-heating chamber to initiate formation of the haematite structure. Similarly, exhaust gases from this zone are drawn to the drying chamber of the pellet bed at 600 - 800 deg. F., lose some of their heat to the pellets, and are passed off to atmosphere. The hot air from cooling the hardened pellets is used as secondary combustion air in the rotary kiln. This arrangement allows fuel consumption to be reduced to approximately 750,000 B.Th.U./net ton. At the same time, operating and maintenance costs are expected to be considerably below any other process achieving this fuel efficiency.

Following preliminary research work, scale operations to test and evaluate the new process were carried out at A-C's pilot plant facilities at Carrollville, Wisconsin. Here, engineers duplicated all stages of the pelletizing and burning multiple ton sample batches of magnetite concentrates from many different sources.

Pilot plant facilities are available for customer tests and work on ores from different mining operations.



Above: Simplified flow diagram of the new process

Below: Grate and kiln equipment at the Allis-Chalmers pilot plant at Carrollville, Wisconsin

SIR ERNEST OPPENHEIMER

BY the sudden death of Sir Ernest Oppenheimer at his home in Johannesburg, the South African mining industry has been deprived of an outstanding leader and spokesman, whose influence and achievements extended far beyond the fields with which his name came to be most conspicuously associated.

In attempting to view in perspective the career of this great South African, one is inevitably drawn to compare it with that of his famous predecessor in the diamond industry, Cecil Rhodes. Though the characters of the two men were widely dissimilar in many respects, both were idealists who had the ability and determination to make their dreams come true; basically there is a remarkable resemblance between the broad patterns of their careers.

Like Rhodes, Sir Ernest Oppenheimer first established himself in the diamond industry, which he was destined to consolidate and expand on the foundations so firmly laid by the architect of De Beers. Having by strength of character and financial ability acquired the control of De Beers and its associated mines, he was instrumental in setting up the unified marketing organization which saved the industry from over-production, when the discovery of the Namaqualand and Litchtenberg deposits threatened a world glut of diamonds. The Diamond Producers' Association and its selling agent, the Diamond Corporation, have been able to maintain stable conditions in the diamond industry through depression and boom, peace and war, and it can fairly be stated that the highly efficient system of organization achieved by Sir Ernest made possible the development of industrial diamonds as a commodity which has become indispensable to technological progress in almost every field.

Closely interlinked with these achievements was the establishment of the youngest of the great financial houses under whose aegis South Africa became by far the largest gold producer in the world. It was in 1917 that Sir Ernest founded the Anglo American Corporation of South Africa, of which he remained chairman until his death. Under his leadership Anglo American became the largest of all the South African mining groups, controlling major producers on the Far East Rand and becoming the predominant influence in the development of the Orange Free State gold-field.

Again in the tradition of Rhodes, Sir Ernest looked northwards beyond the Limpopo River and in 1926 Anglo American began to concern itself with one of the world's oldest but most indispensable metals, copper. To consoli-



date the group's holdings in Northern Rhodesia, Rhodesian Anglo American was formed in 1929.

Through his holdings in Anglo American and their associated concerns, Sir Ernest became one of the richest men in the world, but his interests were far from confined to the administrative and financial problems associated with the production of minerals. A man of progressive and liberal outlook, he was keenly aware of the sociological and economic problems of the two multi-racial countries with which he was principally associated, each with its own special needs and each following its own divergent paths. In the Orange Free State, Anglo American sought to depart from the traditional compound system of the Witwatersrand by endeavouring to introduce family life on the mines. In the Central African Federation the group has made major contributions to economic and social development through its investments in the iron and steel industry, and the Rhodesia Railways, by participating financially in such far-sighted projects as the Kariba hydro-electric undertaking and by its own policy as an employer of African labour. The policy reflected Sir Ernest's belief that in undeveloped areas, mining had a duty to the community to ensure that the distorting impact of a single large-scale industry was, as far as possible, mitigated by assisting the broader economic development of the area.

Yet, again like Cecil Rhodes, Sir Ernest Oppenheimer also made his mark in the political sphere, less spectacularly but to no inconsiderable extent. Elected in 1924 as Member for Kimberley—Rhodes' constituency—he soon became accepted as the authoritative spokesman of the South African mining industry, whose interests he continued to represent with conspicuous ability in Parliament until 1938.

Mining magnate, financier and politician, Sir Ernest Oppenheimer was also a philanthropist who devoted a large part of his time to public service and charitable work. During the First World War he helped to raise and finance the Second Battalion of the Kimberley Regiment. He served on such bodies as the Red Cross and St. John's, gave large donations to educational and other institutions, and subscribed anonymously to hundreds of deserving causes. He was knighted in 1921.

Machinery and Equipment

Plastics in New Wire Ropes

Steel wire ropes and cords play an important—and often vital—part in almost every modern engineering enterprise. Nearly every day new applications are found in which their strength, flexibility and toughness are prime features.

But there has been a limit in some directions, because of conditions which cause rapid deterioration of normal steel-wire ropes. Galvanizing, special compounds and greases, and even stainless-steel wire ropes have not always given the best solution to certain specialized applications.

Now British Ropes, Ltd., are stated to have applied modern thermo-plastics and elastomers to rope-making with highly encouraging results. Research and field testing has been carried out over several years with many different types of plastic protection, and production is now under way. Full production is scheduled for early 1958.

Two techniques are used. One is to sheath wire ropes and cords with a seamless layer of plastic, which completely seals the rope off from outside effects, but in no way alters its strength or flexibility. The rope gets on with the job under a protecting umbrella of plastic.

The other is to make the ropes with a solid plastic core instead of the conventional fibre core. This gives a marked improvement in resistance to fatigue and thus the length of useful life of the rope.

P.V.C., nylon and their co-polymers are used by British Ropes for these new ropes. Their selection depends on the end use. For many applications, the advantages of plastic-sheathed ropes are very considerable.

Indeed, nylon-sheathed wire ropes will resist corrosion, resist fatigue from constant flexing and kinking, and will stand up against abrasion and the action of light.

P.V.C.-sheathed ropes will resist the action of ozone and oxygen, resist ignition, and the action for long periods of strong acids as well as alkalis, provided that the plasticizer employed is suitable. They will also resist to a high degree the effect of direct contact with and immersion in oil, grease, and certain solvents. They will also withstand electric breakdown and the degeneration of physical

characteristics when exposed to sub-zero temperatures.

It would be fair to say that these new ropes, whether sheathed or cored with plastic, open up entirely new fields of rope application. Among their uses are as guying for industrial purposes, catenary cables for power and lighting transmission lines, signalling cable, light duty slings in chemical processes, brake cables and high-tensile wire for grapnel ropes.

At present, plastic-sheathed wire ropes are confined to the smaller sizes, but when full production is under way, the manufacturers state that the method will be carried out on most sizes of wire rope in common use.

NEW LUBRICATION PUMPS

Tecalemit, Ltd., announce a new range of high and low pressure air-operated pumps, suitable for delivering a wide range of lubricants. The high-pressure pump, T.B.H., has a high-pressure ratio of 45/1, which enables a wide range of

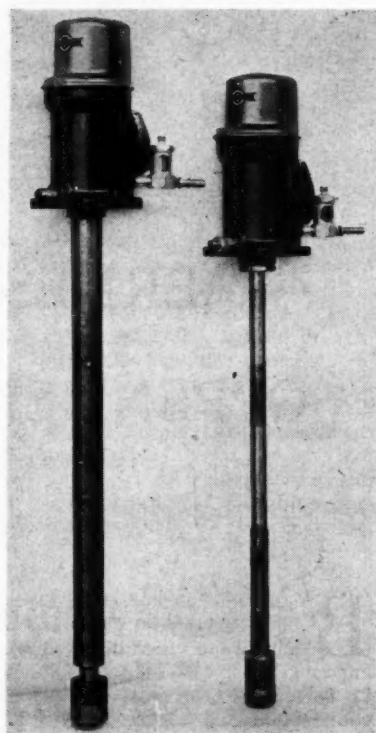
Above: The new Tecalemit-Balcrank high- and low-pressure pumping units. The low-pressure pump is on the left

Below: The first production model of the Euclid S-21 tractor and scraper

lubricants to be pumped at practically any temperature. The air motor is of advanced design and is very economical in air consumption.

Construction of the pump mechanism is simple, with a small number of working parts. A fine gauze strainer is fitted which excludes all foreign matter. Special features are that the pump will not air-lock, has extra suction, is non-fouling, and requires a minimum of servicing.

The twin brother to the high-pressure pump is the low-pressure T.B.L., with the same air motor but with a pressure



ratio of 4/1. This pump is available with float valve for metering and both high- and low-pressure pumps are fitted with an efficient oil mist lubricator on the air inlet, which ensures that the working parts of the air motor are kept regularly lubricated.

These pumps, which can be completely dismantled and reassembled in 15 min. without special tools, are available to suit 56 lb., 112 to 130 lb. and 400 lb. lubricant packages and for 5, 10 and 44 gallon drums, as well as for bulk tanks and containers.

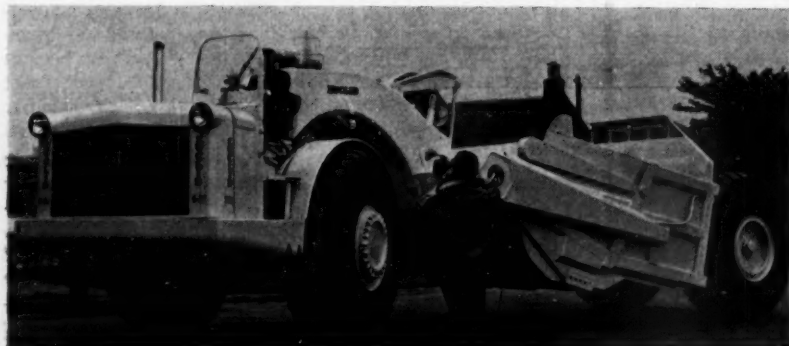
A NEW TRACTOR AND SCRAPER

The latest addition to the range of equipment being produced by Euclid (Great Britain) Ltd. is the Euclid S-21 tractor and scraper. This model, the largest tractor and scraper manufactured in the U.K., will carry a full load of up to 29 cu. yd. at a top speed of 22 m.p.h.

Other capacities are heaped 3 : 1 slope, 24 cu. yd., heaped 1 : 1 slope, 29 cu. yd. The bowl has a 38-in. backboard to prevent spillage. Three identical and interchangeable hydraulic jacks are used to operate the scraper. The engine is a NRTO-6 turbo-charged diesel of six cylinders of a rated output of 320 h.p. at 2,100 r.p.m. and a torque of 850 lb./ft. and 150 r.p.m. The unit is equipped with Allison 500 series torque converter.

The ejector jack is a three-stage single-acting hydraulic jack connected directly to the ejector plate and is not interchangeable with the bowl and apron jacks. Ejection is by positive roll with the snap action at the end of the stroke.

The S-21 scraper has a four-section Euclid cutting edge with a 4-in. maximum drop centre.



A RECORDING OSCILLOGRAPH

The B E R-62 recording oscillograph is manufactured in the U.K. for Seismic Instruments Ltd. by W. G. Pye Ltd. under licence from Electro-Tech, United States.

Although the B E R-62 was designed primarily for seismic exploration, it has applications in many fields of research. The machine records signals varying from d.c. to 100 c/s. photographically on 25 independent traces. Time marking lines appear across the record every 10 milliseconds, every fifth line being heavy as an aid in computing.

The oscillograph is built to withstand rough use in the field with the minimum of maintenance. The chassis is constructed of black anodized aluminium, housed in a stainless steel case. The 25-pencil galvanometer elements plug into a single magnetic block. Each element is completely insulated from the others and can be independently adjusted.

A timing accuracy of 0.02 per cent is achieved by driving a synchronous motor with a valve-maintained temperature-compensated fork. All the electronic components are sealed in a plug-in container which simplifies field servicing.

Power requirements are 12 v. at 3.7 amps and 90 v. at 6.8 milliamps.

OVERLOADERS WITH TORQUE CONVERTER TRANSMISSION

Merton Overloaders and Two-Way loaders will shortly be available fitted with torque converter transmissions as an alternative to the standard friction clutch drive and gearbox. The torque converters are British made. They have been designed and are manufactured by Brockhouse Engineering, Ltd., of West Bromwich. The units were displayed at the recent Building Exhibition on Stand 437-8 by Mackay Industrial Equipment, Ltd., U.K. distributors of the Merton Engineering Co., Ltd.

It is widely acknowledged that torque converter as opposed to direct-drive transmissions have advantages for many loading-shovel applications. Most important of these is the ability of the torque converter to provide an almost infinitely variable range of gear ratios. This means that near-maximum engine speed can be maintained when the loader is almost stationary; further, the torque at this point of near stall is increased by up to three times.

The effect of this is to provide smoothly applied crowding power which gains maximum payloads. Other important advantages are the smooth take-up, lessening the shock loading on engine and final drive and the extreme ease of operation provided for the driver. This latter point is particularly important with Merton Overloaders and Two-Way Loaders, which are capable of an extremely high number of loading cycles per minute.

The transmissions consist basically of a hydrokinetic torque converter with a combined servo-operated epicyclic gearbox which provides the forward and reverse travelling movements of the loaders. The change-speed clutch and forward and reverse brake bands are hydraulically operated. Control of all travelling motion, i.e. reverse, neutral, forward low and forward high, is effected by movement of a single finger-light lever. Forward and reverse working speeds are 5.1 and 5.75 m.p.h. Travelling forward speed is 12.2 m.p.h.

The whole mechanism of torque converter, epicyclic gearbox, power take-off, casings, etc., are of exceptionally heavy construction in order to meet the very arduous duties which the Overloader and Two-Way loader has to undertake. Given normal attention to the maintenance of oil level and very occasional brake adjustment, little service will be necessary over long periods of operation. Considerable attention has been given in designing the unit to simplify the dismantling and reassembly of the components of the transmission when required.

DUAL-PURPOSE WATER STERILIZER

A new dual-purpose ultra-violet water sterilizer for low volume drinking or process water has been introduced by Hanovia (Lamps Division of Engelhard Industries), Ltd.

Known as the Model 6 dual-purpose sterilizer, the sterilizer will treat up to 400 gallons of water per hour as a continual flow unit. Its lamp assembly can be quickly detached from the outer chamber and used separately as an immersion sterilizer for water tanks. For static tanks of, for example, 50 to 100

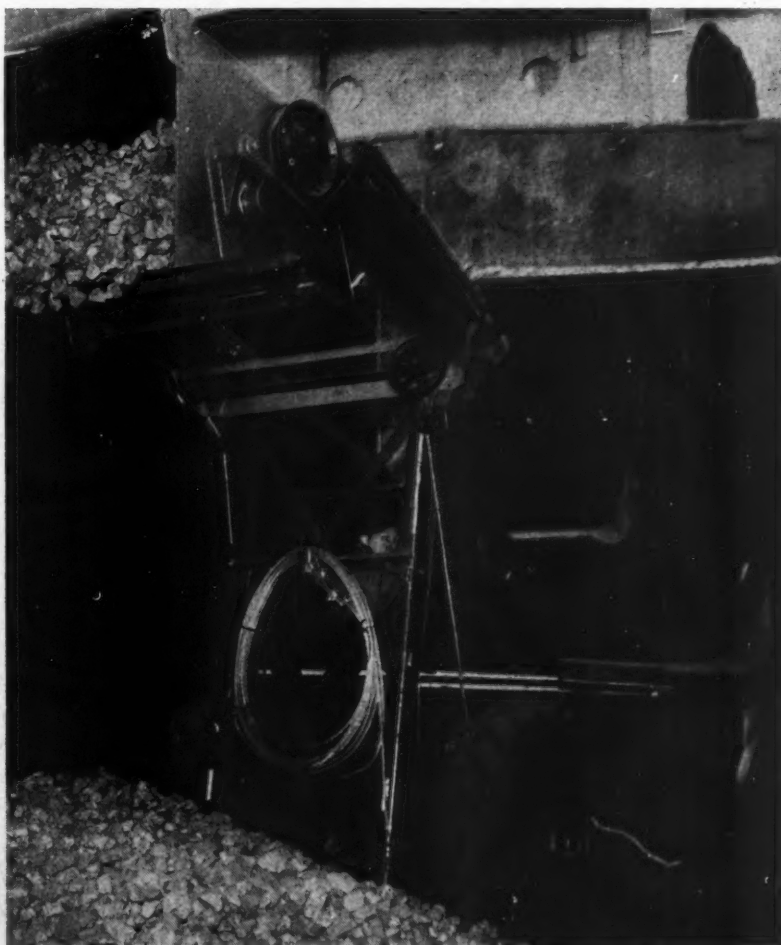
gallons capacity, the immersion unit will deal with a demand of about 300 to 400 gallons per day.

This complete unit has an overall length, including terminal box, of about 27 in., and incorporates a more powerful 44-watt low-pressure mercury vapour discharge tube in clear quartz, made in U-form to fit inside a clear quartz envelope to provide a more robust unit and to ensure a more efficient output under varying ambient temperatures. It can be operated on an a.c. mains supply of 200 to 250 watts, 50 cycles; while a special transformer can be supplied for a 100-watt a.c. mains supply. The total unit consumption is approximately 150 watts.

The ultra-violet lamp has a normal effective life of 2,500 to 3,000 hrs., after which the U.V. output is appreciably reduced—although the lamp may continue to operate for several thousand more hours. Assuming the electricity consumed per hour by the unit costs 0.2 pence, the treatment cost per 1,000 gallons of water should not be greater than 8.5 pence. This estimate includes replacement of the U.V. lamp after 2,500 hrs. of use.

The new sterilizer is very adaptable to different requirements; its applications including the production of drinking or process water at mines.

A Merton loader trimming iron ore in a ship's hold



MINING MISCELLANY

E. J. Lavino and Co., United States, are to build a plant at Freeport, Texas, for the production of high grade magnesite from seawater.

The American-Austrian Magnesium Co. is reported to have taken over the magnesium carbonate mine in Vavdos-Chalcidice, Greece, in implementation of the recent agreement with the State. Production is expected to start in six months' time with the following outputs; magnesites, 23,000 tons, caustic magnesium 12,000 tons and enriched chromium 5,000 tons a year.

To assist coal mines in developing improved programmes for combating fires, the U.S. Bureau of Mines has released a report describing a study of fire-fighting facilities at 11 mines in the United States. The survey revealed that while the types of equipment and organization varied, the least costly of five recent coal mine fires resulted in a loss \$50,000 greater than the cost of all fire-fighting facilities at the most completely equipped mine visited in the study.

Government delegations of the U.S.S.R. and India signed an agreement in Delhi on November 9, 1957, on co-operation in the construction of industrial enterprises in India and on the Soviet Union granting India a loan of 500,000,000 roubles. The loan will be used, amongst other expenditures, to finance extraction and processing of coal.

A thirteen-man Japanese coal-mining mission, which has already studied mining techniques and organization in France, Germany, Belgium, Holland, Switzerland and Italy, has arrived in London to inspect British coal mines and have talks with officials of the National Coal Board. The leader of the mission is Mr. Mitsutomo Ishida, managing director of the Mitsubishi Mining Co., Ltd. He said that Japan's objective was to raise coal output, which this year was expected to reach 54,500,000 tons, to 72,000,000 tons in 1975. Imported German mining machinery was already helping to increase output and Japan was seeking a World Bank loan for a large development programme. One of the mission's main aims is to study differences in the organization of the coal industry in countries where it is nationalized and others in which it is still in private hands.

According to the Geological Survey of Israel, more than 1,000,000 tons of flint clay with a 45 per cent alumina content, used to make brick linings for industrial furnaces, are to be found in the Central Negev. In many places, it is stated, the alumina content of the ore exceeds the 50 per cent mark and the mineral can be classified as bauxite. Several drillings are now in progress in order to obtain detailed information about the district. Drilling operations are being carried out jointly by the Geological Institute and the Israel Mining Corporation.

Prospecting licences issued in Southern Rhodesia during the first nine months of 1957 showed a big increase over the

corresponding period last year, being 1,148 against 823. Base mineral registrations now current number 2,108 over an area of 126,000 acres. There were 1,680 blocks current in September, 1956. Gold registrations, on the other hand, have shown a gradual decline. Current blocks registered in September last year were 920, but now there are 852. Forfeitures exceed registrations. In September there were 17 uranium claims, mostly in the Beit Bridge and Wankie areas.

Two Bills which will benefit British mining interests have been published in Ghana. One is a Mineral and Profits Tax Bill. The other, an income-tax amendment Bill, becomes necessary because of the introduction of the first. It is intended that the new form of taxation, which would be eligible for relief under the existing (British) double taxation order of 1947, should replace the present minerals duty, which is not eligible for relief. If passed into law, the Bill will be effective on a retrospective basis to April 1, 1956.

The Eagle Picher Co., a leading U.S. lead-zinc producer, has announced that during the current week it will resume mining and milling operations in the Tri-State area after being closed for some months. It has been stated that this should result in about 2,000 tons of zinc

concentrate per month and an unspecified quantity of lead concentrate.

A \$1,000,000 investment by a newly formed mining company in Jamaica, seeking to develop the country's iron and copper deposits, has been announced by Mr. C. C. da Costa, international representative of the Jamaica Industrial Development Corporation. The new company, known as International Metals, Ltd., has purchased all shares of the Mavis Bank Mining Co., which held mining leases and exclusive prospective permits on approximately 7,000 acres in St. Andrew Parish. There is said to be "every indication of a body of iron ore of considerable magnitude" in the concession acquired on the island, as well as "promising indications of copper".

The World Bank, jointly with nine U.S. and Canadian banks, has made a loan of \$32,500,000 to the Tata Iron and Steel Co. of India (see this column, November 22, 1957). The loan, which is for 13½ years and will bear interest at 6 per cent, is to help in the completion of an expansion programme aimed at raising Tata's steel ingot producing capacity to 2,000,000 tons annually by 1960. Tata accounts for more than two-thirds of India's present steel production.

A new ventshaft, 1,500 ft. deep and 24 ft. dia. (20 ft. inside the concrete) has

A typical exploration set-up for uranium prospecting in the Northern Territory of Australia using an Atlas Copco wagon drill



been sunk by Allied Constructors Pty., Ltd., in 334 days at the Coal Cliff Colliery, New South Wales. Having regard to all the variables involved, world records in shaft-sinking are extremely difficult to establish, but this is certainly an achievement of the highest order. It involved cutting 25,000 cu. yds. of rock and placing 6,000 cu. yds. of concrete. The labour force consisted of 28 men working six days a week on a three-shift basis. An eight-fingered mechanical grab capable of extracting one ton of rock per charge was employed. The new vent shaft is being installed at a cost of £A250,000 to extract 300,000 c.f.m. from the mine.

According to the Johannesburg *Star*, great mineral wealth may lie beneath the croplands of the eastern Orange Free State, and during the next few months a major effort will be made to uncover the secrets of what many people believe to be one of the richest areas in Southern Africa. A mining company with interests throughout the country has taken an option of 400,000 acres in the area. Gold and diamonds are expected to be among the finds. Some prospectors, the newspaper states, believe that the outer ridge of the "gold saucer" containing the Witwatersrand and the present Free State fields will be found in the eastern part of the province. Others claim to have discovered asbestos at Ladybrand and Clocolan, and another company is prospecting for diamonds.

PERSONAL

National Mining Corp., Ltd., have announced that Major-General W. W. Richards, who retired by rotation at the recent annual general meeting, did not seek re-election, and therefore ceased to be a director. Mr. Guy Houghton Brown has been appointed a director. Mr. C. J. Burns has been elected chairman.

Mr. E. C. Baring has been appointed a director of Free State Geduld Mines, Ltd., with Mr. D. B. Hoffe as his alternate.

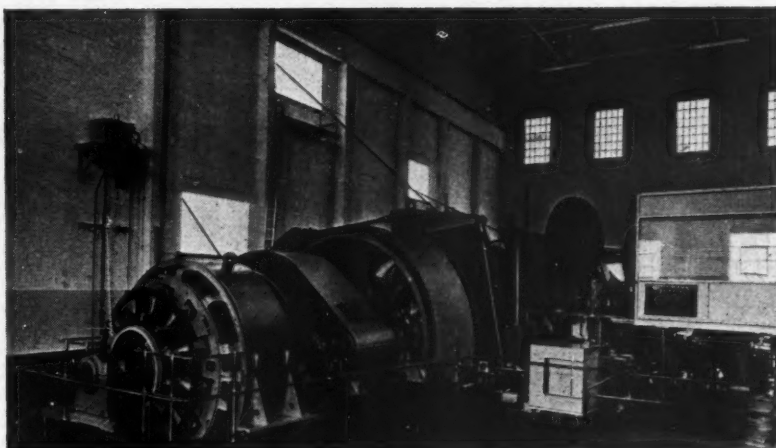
Grooved Secretaries, Ltd., have been appointed secretaries to the following companies in place of Mr. Maurice O'Bart, who has relinquished his office: The Kinta Tin Mines, Ltd., Tanjong Tin Dredging, Ltd., and Pusing Rubber and Tin, Ltd.

Mr. Thomas B. Kitson, Mr. A. F. de Breyne, and Mr. Richard C. Wright have been appointed directors of Kamra Tin Dredging, Ltd. Mr. P. J. Burgess, Capt. H. S. M. Harrison-Walle and Mr. W. A. K. Ingoe have resigned from the board. These changes follow the offer by Standard Industrial Trust to the liquidator of Kamra Tin Dredging to purchase all the shares in that company.

Brig. M. A. W. Rowlandson has been appointed a director of Bancroft Mines, Ltd., Nchanga Consolidated Copper Mines, Ltd., and Rhokana Corp., Ltd. Mr. R. H. W. Bruce has resigned from the boards of these companies.

Mr. A. V. Conrad has been appointed a director of Selection Trust, Ltd.

Mr. R. H. MacWilliam has been appointed a director of San Francisco Mines of Mexico, Ltd., in place of the late Mr. E. Fraenkel.



This 2,200 h.p. electric winder with d.c. Ward-Leonard drive is one of several supplied by Metropolitan-Vickers Electrical Co. Ltd. to Anglo American Corporation of South Africa Ltd. for service on the Copperbelt. This unit is installed in the South ore body shaft at the N'kana mine of Rhokana Corporation Ltd.

COMPANY EVENTS

Strategic Materials Corp. and Gunnar Mines, Ltd., have formed a new company to acquire chrome ore claims in Manitoba owned by Gunnar Nesbitt Labine Uranium Mines and Chondrite Mining Corp., Ltd. The new concern, Stannar Mines, Ltd., will employ Strategic's process for treatment of low-grade ores.

Ruston-Bucyrus, Ltd., held a conference for their export distributors from October 14-18, 1957. This was the second conference of this nature in the company's history, the first having taken place a quarter of a century ago. Representatives from 35 countries attended and were welcomed by Mr. E. S. Everitt, managing director. The agenda consisted

of visits to the Ruston-Bucyrus excavator works to study assembly processes and to see the machines in various stages of production, as well as in action on the test ground. Of particular interest was the 30-RB machine with its special feature of air control. The new 150-RB Ward-Leonard electric 6 cu. yd. excavator was also on view.

AGENCIES WANTED

Mr. Hakon Gertsen, Raadhushpladsen 4, Copenhagen V, is interested in contacting U.K. manufacturers or suppliers of raw materials for the glass industry; more especially soda, sand, chalk (with a low iron content) feldspar and dolomite. B.O.T. Ref. E.S.B. 27963/57. Telephone inquiries to Chancery 4411, extension 776 or 866.

CONTRACTS AND TENDERS

The following future procurements have been announced by the International Co-operation Administration (I.C.A.):

Pakistan

The Gilani Co., Ltd., Barnes Road, Quetta, wish to receive quotations from U.K. manufacturers for various commodities including electric winches,

pumps, air compressors, generators, electric motors, wire rope, miners' lamps, electric cables, a geiger counter, and rubber hose. Ref. E.S.B. 27622/57. Telephone Chancery 4411, extension 776 or 866.

Vietnam

	Contract Period	Terminal Delivery Date	Amount (in U.S. dollars)
Tin, tin base alloys and products (PA 30-696-99-L1-8239) ...	28/10/57-30/4/58	31/10/58	50,000
Lead, lead base alloys and products (PA 30-694-99-L1-8241) ...	28/10/57-30/4/58	31/10/58	25,000
Aluminium, aluminium base alloys and aluminium products (PA 30-691-99-L1-8242) ...	28/10/57-30/4/58	31/10/58	200,000

Republic of Korea

	Contract Period	Terminal Delivery Date	Amount (in U.S. dollars)
Aluminium, aluminium base alloys and aluminium products (PA 89-691-99-L1-8215) ...	30/10/57-30/4/58	31/10/58	580,000
Zinc and zinc base alloys and products (PA 89-697-99-L1-8216) ...	30/10/57-30/4/58	31/10/58	260,000
Tin and tin base alloys and products (PA 89-696-99-L1-8217) ...	30/10/57-30/4/58	31/10/58	210,000

B.O.T. Ref. E.S.B. 28020/57 I.C.A. Telephone enquiries to Chancery 4411, extension 354.

Metals and Minerals

Protection of Uranium Producers Against Price Cutting

Fears that a situation might be reached where there might be price-cutting of uranium have been expressed by Dr. van Rhijn, South African Minister of Economic Affairs, who stated in Pretoria that he had discussed with United States and Canadian authorities means of protecting producers against undercutting. Dr. van Rhijn, who had returned to South Africa from a visit abroad, said that his discussions in the United States and Canada had been well received, and that the interests concerned had promised to examine the setting up of a standing committee representing uranium-producing countries to deal with possible undercutting.

The Minister stated that Canada and the United States each produced 8,000 tons of uranium a year, and both countries planned to increase production to 15,000 tons a year. South Africa was now producing some 6,000 tons a year, valued at about £35,000,000.

Despite the expanding demand for uranium, which may be expected to become still more rapid as the nuclear industry gets into its stride and becomes increasingly international in scope, producers are understandably viewing with a certain amount of anxiety the possibility of a difficult period after the present sheltered conditions have ceased to exist. A.E.C.'s foreign ore buying contracts with uranium producers will expire on March 31, 1962, when the present United States programme dies, but Canadian mines are bound to continue supplying the United States Government under options which run from the end of the present contracts until December 31, 1966. South African producers have contracts which expire between 1963 and 1966, depending on the date that full production was achieved. By that time world production may exceed 40,000 tons of U_3O_8 a year.

Dr. Willard F. Libby, Commissioner of the A.E.C., has estimated that within a decade or two world requirements will probably range from 40,000 to 100,000 tons of U_3O_8 per year. Having regard, however, to the potential growth of nuclear power generation throughout the world and in such virgin fields as ship or aircraft propulsion, current projections of future uranium requirements may well be substantially exceeded.

Nevertheless, the possibility cannot be excluded that the tempo of expansion in the nuclear power industry might not be rapid enough initially to absorb the projected Free World output if military orders ceased in the early 1960s.

Apart from the danger that a period of temporary over-supply might lead to undercutting by producers themselves, it is, of course, evident that, despite the advent of other purchasers, the United States and United Kingdom governments will long continue to be by far the largest customers of the Free World uranium industry, and that with the large stocks arising from their existing contracts, they will be in a position to bring down the future price should they so desire. Having regard to the immensity of their own requirements, however, it is scarcely con-

ceivable that they would jeopardize future supplies by offering prices at which mining and exploration could not be economically undertaken.

It is, of course, prudent and desirable that producers should take steps to guard against the possibility of undercutting before it can occur, instead of waiting until the damage has been done. What is perhaps surprising is that the *démarche* should come from South Africa. One would have thought that the South African producers were particularly well placed to meet whatever competition may be presented in the coming years, since most of their uranium output is recovered at relatively low cost as a by-product of gold-mining operations, and in plants which will be fully paid for when existing contracts expire. That is not to say, of course, that they would relish having to bring down the price of their uranium any more than producers in any other country who are perhaps less favourably placed to do so!

INGA TO GO AHEAD

The Belgian Government has approved the construction programme, scheduled to cost £1,130,000,000, for a series of dams and power stations to be built at Inga, on the Lower Congo river. The project will provide a total power of some 25,000,000 kW. It envisages the creation of an "African Ruhr" where aluminium, electro-chemical, and other industries would be established. Work will begin on the first stage of the programme in 1959 and a production of 1,500,000 kWh. is planned by 1964. It is understood that the first phase of development will be financed as far as possible with Belgian capital. The impact of this ambitious undertaking on the various schemes now under way or projected for the production of aluminium in French West Africa (*vide* our issue of November 1, 1957, pages 516 and 517) cannot as yet be clearly discerned, but in the long term the world's growing needs will doubtless provide a ready outlet for all the metal that the African producers with their low power costs can supply. On completion of stage one, power will be sold at Inga at about 24 Congo cents per 100 kWh., but it is understood that eventually the cost of power will be reduced to half this figure.

The British Aluminium Co. has joined "Alumina", the syndicate planning to produce aluminium at Inga. The syndicate also includes Belgian, United States, French, Swiss, German, and Italian groups.

Since the publication last week of our note on the consumption of metals in American motor cars (*The Mining Journal*, November 22, 1957, page 619), it has been announced that Chrysler is using 100 lb. of aluminium per car this year against an average of 9 lb. in 1946, while the industry as a whole is using 45 lb. per car compared with 2 lb. eleven years ago. However, Chrysler stated that it must be demonstrated that aluminium

can do the job as well or better than other materials; that it can be produced in adequate quantities; and that the price is competitive. General Motors believes it is entirely possible that average use of the metal may increase to 75 lb. per car by 1960. The 1958 model Ford used 48 lb. of aluminium, an increase of 50 per cent over 1955, and aluminium content of the 1959 model will be higher by a further 10 per cent. Among ideas under study, a House Small Business Subcommittee was told, are aluminium roofs, bumpers, radiators, engine blocks, brake drums, and trim.

MICA EXPORTS INCREASE

Exports of mica from India in the first half of this year rose to 14,099.5 tons from 11,232.5 tons in the corresponding period of last year. Nevertheless, export earnings from the mineral during the first six months of this year at Rs.48,700,000 showed only a nominal increase of Rs.5,700,000 because the bulk of the increase took place in exports of scrap mica, which fetches a low price in the world market.

The United States maintained its position of leading buyer of Indian mica with an import of 86,879 cwt. valued at Rs.18,200,000. The United Kingdom was the second largest customer importing 4,531.9 tons of mica worth Rs.8,550,000. Germany and Japan, the two other important buyers, took mica worth Rs.5,400,000 and Rs.6,200,000 respectively.

DOW BUYS MAGNESIUM PLANT

The Dow Chemical Co. has announced the purchase of the government-owned magnesium facilities at Plant B near Freeport, Texas, the purchase price being \$20,000,000. Capacity of Plant B is about 45,000 tons per year. Starting in April, 1951, Dow operated this plant for government stockpiling until the end of December, 1953, since when it has leased and operated it on its own account. The company has been producing magnesium from its Plant A facilities at Freeport since 1941.

Although third quarter production of primary magnesium in the U.S. fell slightly below the first and second quarter levels, output for the first nine months of the year is some 31 per cent higher than for the same period in 1956. According to the Magnesium Association, indications point to a total production for the year amounting to at least 40,000 tons as compared with an actual output in 1956 of some 34,000 tons.

NEW BAUXITE PROJECT

The Queensland Parliament has been given notice of legislation approving Australia's largest single mining undertaking, the £A50,000,000 Cape York bauxite scheme, which is to be carried

out by Consolidated Zinc Corp. through its subsidiary, Commonwealth Aluminium Corp. Pty., Ltd. The legislation will ratify an agreement between Commonwealth Aluminium and the State Government for the development of the deposits.

EUROPEAN METAL MARKET

The European metal industry, employing over 3,000,000 workers, is of the opinion that the tariffs on raw materials entering the European market should be as low as possible, the Dutch Employers' Union has stated. This issue was the subject of recent discussions held in Frankfurt among the employers' associations of the six European Community countries. The talks are to be continued later.

GOLD FROM RUSSIA

Russian gold normally reaches Britain by air, but recently the first shipment by sea since 1954 arrived in this country. It is estimated that since the end of October the Soviet bloc has sold at least 40 tons of gold to the West, mainly

to Switzerland, through the Banque Commerciale pour l'Europe du Nord in Paris. This is equivalent to roughly \$50,000,000. The gold is for forward delivery in London and is contributing to the present strength of sterling. The Soviet Union normally balances her trade with the rest of the world by sales of gold. It will be recalled that similar sales on a much larger scale started in November, 1956, and continued until the spring of this year. It is not anticipated that this year's Russian gold sales will approach the level of those a year ago, when the U.S.S.R. had to meet Hungarian trade debts worth at least £20,000,000.

U.S. RUTILE PRODUCER

Metal and Thermit Corp. has entered the United States rutile and ilmenite market with the formal opening of its new mine and ore-processing plant in Hanover County. The new plant, with a capacity of 100 tons of ore hourly, represents an investment of \$1,250,000, and is scheduled to become an important domestic source of rutile. It is expected to supply 12 per cent of United States rutile requirements, most of which are at present imported.

its next meeting, will discuss the question of imposing export restrictions and at the same time making any necessary arrangements to ensure that the Buffer Stock Manager can continue to support the cash price until the cuts start to have an effect. Whether the floor price will be lowered or not is a matter on which there is a difference of opinion, but the majority feel that no alteration is likely, as the amount of extra tin which could be bought by lowering the price would in no way compensate for the injury done to the scheme as a whole if prices were moved again. Being wise after the event, it can now be seen that the original alteration of the prices in an upward direction was unnecessary and probably did much psychological harm.

The irony of the situation is that a scheme which was introduced to regulate price fluctuations is now probably going to be responsible for a very sharp upward movement from its floor price of £730 per ton to the price range of £830/£880 at which it can sell metal, as the tonnage which has been absorbed into the pool over the last few weeks is of a size which must create a temporary shortage at some time in the future, if export quotas are imposed. The amount of restriction is also a matter for speculation and some quarters have suggested that it may be as high as 15 per cent, but it appears that this could very well be too high as all that has now to be absorbed is the estimated over-production of 1958, the surplus for this year having already entered the Buffer Stock.

COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

For the first time for many months copper has been pushed out of the spotlight and tin has taken its place on the London Metal Exchange. The turnover in copper has dwindled and that for lead and zinc has been at a very low level, there being a complete lack of news to help revive interest.

COPPER IN DOLDRUMS

The undertone on the copper market has continued unsteady and at the end of last week the U.S. customs smelters made a further reduction in their price to 25 c. per lb. This action was followed automatically by a reduction in scrap prices, but it is a noteworthy feature that offerings of all types of scrap remain very limited. The U.S. domestic producers have maintained their price at 27 c. per lb. and, although there is talk that this may have to be lowered on the grounds of the span between it and other prices being too big, it is freely admitted at the same time that such action would not increase business.

Figures issued during the week showed a slightly brighter picture as far as products from wire mills, brass mills and foundries were concerned, as these fabricators used more copper in their products shipped during October than they had since January of this year. Stocks of metal held by this same group also showed a reduction at the end of October over the end of the previous month.

In London, stocks in official warehouses remained almost unchanged so there has been no pressure to alter the contango rate: activity in the U.K. and Europe has been disappointing and all hopes of an end of year upsurge have now been given up. On Thursday the Belgian copper price was reduced to the equivalent of 23.15 c. per lb.

MORE CASH FOR BUFFER STOCK

As mentioned at the beginning of this article, tin has been the most active market during the period and has provided the major subject of conversations. The only new facts to have emerged are that the date of the meeting of the Tin Council has once more been advanced, this time to December 4, and that it has now been made known that the first supplementary contribution has been asked for from producing countries, which confirms that the Buffer Stock must now be holding, or expects to hold in the near future, 10,000 tons of metal. It is interesting to note that the delegates of the producing countries have recommended their governments to put up this contribution in the form of cash, which is a further indication of the desire to place the Buffer Stock Manager in a position to be able to continue to support the market, since this would not have been the case had a recommendation been made to make the contribution 75 per cent metal and only 25 per cent cash.

The three-months' quotation reached a low point on Friday last when a price of £680 per ton was reached, but after week-end consideration, dealers took a somewhat brighter view on Monday and a strong recovery set in, not only in London but also in Singapore, and on Thursday morning the Eastern price was equivalent to £711½ per ton c.i.f. Europe.

General opinion now appears to have crystallized in favour of the Buffer Stock being able to ride out the present storm, and weight is lent to this by the fact that offerings of cash metal are tending to diminish after the enormous tonnage which was dealt in last week. It is now generally believed that the Council, at

LEAD/ZINC TICKING OVER

The lead and zinc markets have been extremely quiet, with routine demand continuing but with signs that even this may slow down a little pending the results of the Tariff Commission on increased import duties and quotas in the U.S. It is understood that a number of powerful statements have been made before the Commission against any alteration in import duty, but informed opinion still considers that an increase is inevitable, although the probability of the imposition of import quotas is by no means considered certain.

The G.S.A. have again called for tenders for lead and zinc for delivery by January, 1958, and if the Tariff Commission make a fairly prompt recommendation these may prove to be the last of such tenders.

Closing prices are as follows:

	Nov. 21		Nov. 28	
	Buyers	Sellers	Buyers	Sellers
COPPER				
Cash	£183½	£183½	£183½	£184
Three months ..	£187½	£188	£188	£188½
Settlement ..		£183½		£184
Week's turnover	8,625 tons		7,800 tons	
LEAD				
Current ½ month	£79½	£80	£79	£79½
Three months ..	£80	£80½	£79½	£80
Week's turnover	3,850 tons		2,625 tons	
TIN				
Cash	£730	£730½	£730	£730½
Three months ..	£704½	£705	£716	£717
Settlement ..		£730½		£730½
Week's turnover	2,960 tons		2,800 tons	
ZINC				
Current ½ month	£66½	£66½	£66½	£67
Three months ..	£65½	£65½	£66½	£66½
Week's turnover	6,425 tons		7,100 tons	

London Metal and Ore Prices appear on page 661.

The Outlook for Copper

Sir Ronald Prain at the R.S.M.

In the last of a series of three Special University of London Lectures delivered at the Royal School of Mines last Tuesday, Sir Ronald Prain made some very pertinent observations on the outlook for the copper industry.

After reviewing in detail the growth in copper production since the beginning of the 19th century, he said that it had been estimated that by 1960 or 1961 world capacity, excluding Russia, would have been increased to about 4,000,000 tons against a current production rate of about 3,000,000 tons per annum.

Continuing, Sir Ronald said, "The growth of the copper industry can be closely related to the growth of civilization, by which I mean not only the material standards which have begun to be claimed by mankind, but also by the number of people in the world.

"Steel, copper and population seem to be intimately connected factors, and it is on the projection of these that the copper industry makes a projection of its future. Today we have an additional factor which has to be taken into account—the fact that the use of copper *per capita* throughout the world will increase as more and more people demand higher standards of living. As a matter of interest the annual copper consumption of the United States on a *per capita* basis is about 18 lb. whereas for the world as a whole it is about 3 lb. *per capita*, and outside the United States only about 2 lb. *per capita*. Sweden shows the highest figure with about 22 lb. *per capita*".

WORLD RESERVES

Sir Ronald then went on to discuss the extent of the world's copper reserves: "Excluding Russia, about which information is lacking, we find that the copper production of the world today runs at about 3,000,000 tons per annum, and comes from some 100 mines. To the extent that these mines publish figures of ore reserves, it is interesting to note that these reserves amount to between 7,000,000,000 and 8,000,000,000 s.tons of ore.

"I have calculated that the average grade of these ore reserves is 1.55 per cent, sufficient at estimated mining and metallurgical recoveries to yield some 87,000,000 l.tons of copper metal, which is about 30 years' supply at the present rate of usage.

"On the other hand," he continued, "it is unusual for companies to declare their full reserves, either as a matter of policy or because of the simple fact that very few mines know the full extent of their reserves. A recent meeting of the International Geological Congress calculated that indicated copper reserves of all the world might be of the order of 190,000,000 tons of recoverable copper, which would be sufficient to supply the world for 60 years at the present rate of consumption, or for 48 years if the rate of consumption should increase to 4,000,000 tons a year as is expected within the next five years or so.

"Looking further ahead, it is impossible to say today where the world will get its copper. I for one, however, believe that there will be more discoveries made. This view is not held universally. I should add, and I have heard an eminent American mining engineer say that in his opinion no more big mines will be discovered in the United States, and that in fact there is no mine being operated in the United States today which was not already known in the 1890's. Be that as it may, I feel certain there are still great areas in South America, and Africa particularly, which may be expected to yield copper from orebodies which are still undiscovered.

"We must not forget too that copper is a virtually indestructible metal. The only uses to which it is put where it seems to disappear from the scene are the chemical uses. In all other uses copper sooner or later comes back to the market, and it has been a feature, and a confusing one, of the commercial picture of copper that the element of scrap which keeps on being remelted time and again is one of the major factors in the supply situation."

SUBSTITUTION

Sir Ronald had the following observation to make on the subject of substitution: "It is possible too that substitutes will be discovered for certain uses of copper. We know about some of these already, and these resolve themselves in the last analysis to a question of relative prices. It is probably indisputable that copper has characteristics which cannot be found in other metals, and for those reasons copper will be used rather than other metals for certain purposes provided that its price makes it economic to do so. A shortage of copper resulting in abnormally high prices can easily set back the consumption. Many uses have already been lost to substitute materials, and the price differential is now such that many of these uses will not be returning to copper. We can, therefore, forget those and concentrate on its present uses, and it is on the basis of these uses that I have given you the forecasts of what consumption may increase to in the next few years".

COPPER COSTS

In discussing the industry's cost structure, Sir Ronald pointed out that about 73 per cent of all copper produced in the Free World came from mines with costs varying between £80 and £240 per ton, while a further 9 per cent was produced as a by-product metal. Despite the lowering of the grade of ore worked over the past 50 years, the costs of producing copper (after allowing for the depreciation of currencies over this period) were no greater today than at the beginning of the century, a fact which illustrated the great technical advances in the industry,

as well as the advantages accruing from mining on the most gigantic scale."

Continuing, he said, "At the same time it must be admitted that there may be now very little room left for further improvement under these two headings. Technological knowledge is such that already it is extracting almost as much as can be extracted from a ton of ore, and at the same time operations are now conducted on a scale which it is difficult to think can be greatly expanded. If these two surmises are correct, it is difficult to see where further reductions in cost are going to occur. The increasing costs of labour and equipment and the constant process of the depreciation of currencies, must, it seems to me, lead from now on to an increase in the unit cost of producing copper.

"In the long run this must lead to higher prices, though not, of course, necessarily to higher profit margins. This would be a deterrent to the continued use of copper, if it were not offset by the fact that similar processes are at work in the case of the other metals which can be said to constitute a competitive threat to copper."

PRICE FLUCTUATIONS

On the volatility of copper prices Sir Ronald had this to say:

"The wide difference in the cost of producing copper at different mines is one of the reasons why the price of copper has always been subject to the laws of supply and demand. It would be impossible to establish a copper price relating in any way to costs. The cost feature in copper mining and the wide differences I have referred to militate against the establishment of stable copper prices.

"In my opinion the other reason why copper prices historically have been so volatile is the influence of the scrap factor. The existence of this large amount of scrap, which is continually coming back for treatment, and the fact that certain mines do not have their own smelters, has led to the creation over the last hundred years of the so-called customs smelters, that is to say smelters who take in scrap or raw copper and convert it into finished copper.

"These smelters have no mine of their own and consequently are concerned only with taking in as much as they can sell or, conversely, selling as much as they take in. The considerable influence of the customs smelters on price trends has been one of the features of the copper market of this century.

CHANGING ROLE OF THE U.S.A.

"From the point of view of world movements of copper, possibly the greatest change which has occurred in recent years, and one which is likely to be permanent and to have far-reaching effects, is the fact that the United States, which for so many years was the largest exporter of copper, is now an overall importer. This has meant that the centre of gravity of the copper market has to some extent moved from London to New York and henceforth the prosperity of the copper industry will depend to a much greater extent than hitherto on the industrial situation in the United States."

Mining Finance

Tax Reliefs for "West Africans"

Rather sooner than might have been expected, the Ghana Government this week has announced the publication of two bills, the second complementary to the first, which potentially or positively will benefit the numerous United Kingdom mining undertakings operating in the territory. The first is a Minerals and Profits Tax Bill, and the second an Income Tax Amendment Bill. The drafting of the bills has been in the hands of the Ghana Government for some time past.

Hitherto, the position has been that the Ghana minerals duty, which was payable by a number of mining companies controlled in the United Kingdom, has not been chargeable against United Kingdom taxation. What the Ghana Government is now doing is to replace the existing minerals duty by a new form of taxation which will be eligible for relief under the existing United Kingdom double taxation order of 1947. Thus a minerals profits tax will replace the minerals duty which, should it be passed into law, will be retroactive to April 1, 1956.

The existing minerals duty has been

calculated on a sharply graded sliding scale based on the ratio of gold yield (subject to amortization and other allowances) to the value of output. With this ratio at 15 per cent or less, no duty was payable. At 20 per cent, a duty of 1 per cent became due, and the scale continued to rise until at a ratio of 80 per cent as much as 21 per cent became payable. So far as the Ghana mining industry is concerned, it is believed that only two companies are likely to be immediate beneficiaries—Ashanti and Ariston. But the ultimate benefits, should, for instance, the gold price rise, would be substantial for other lower-grade producers.

The new bills will, of course, also be of substantial help to Consolidated African Selection Trust, which in recent years has been badly hit by unrelieved double taxation in respect of its Ghana operations. The C.A.S.T. chairman emphasized in his recent annual statement that the company would continue to benefit from the replacement of the minerals duty by a tax, even if the company qualifies as an Overseas Trading Corporation in the future.

BUFFELS' EXTENSION PLANS

A decision to increase the capacity of the gold reduction plant to 150,000 tons per month is announced by Buffelsfontein Gold Mining, the rich young Klerksdorp gold and uranium producer, in its report for the year ended June 30. The finance will be found from the company's own resources. Corresponding additions to Buffels' uranium, acid and pyrite plants are also to be made, the cost in this case to be met partly from profits and partly from borrowings from sources other than the usual British and American authorities.

In the past few months Buffels has milled 112,000 tons per month, still slightly below the plant's rated capacity of 120,000 tons.

KANSANSHI ON CARE AND MAINTENANCE

Earlier this week, the Kansanshi Copper Mining Company announced that the mine is being placed on a care and maintenance basis pending a full report and recommendations as to future action from the consulting engineers.

Pumping at Kansanshi has given as much information as can be obtained with the equipment available at the mine and, on present evidence, it does not appear that de-watering would present a major engineering problem. Expenditure on additional pumping equipment will be necessary if de-watering is to be continued.

The pumping to date has indicated a flow at the existing head of just over three million gallons per day, some of which is coming through from the north shaft area, either as a leak through the watertight door or percolation through the vein systems or fissures. Since the mine was re-opened, some 3,500,000 gallons per day have been flowing from the north shaft area and have been pumped out of the mine. It is not clear how much of this water is included in the new flow of three million gallons. The level of water in the north shaft remains above that in the main south shaft, indicating a restriction on the flow across.

It is hoped that a further statement will be made in the course of the next few weeks.

NEW DISCOVERY AT MT. LYELL

In discussing the operating loss of £90,000 incurred by Mount Lyell Mining and Railway Co., of Tasmania, the chairman, Mr. W. E. Basset, said that the loss would have been greater had Australian producers continued to sell on the usual basis of London quotations instead of at the average Australian price. He stated also that continuation of the company's mining operations depends either on favourable recommendations of the Tariff Board, and consequent action of the

LONDON MARKET HIGHLIGHTS

Generally speaking, Kaffirs held up well during the week to November 27. There was no striking advance in prices nor was there any big expansion in business, but the undertone remained very sound and was quite unshaken by news of the death of Sir Ernest Oppenheimer.

The firmest spot in the market was St. Helena which moved from strength to strength on the recent good borehole result reaching at 36s. 6d, a new high since 1951. Union Corporation rose to 41s. 6d. in recognition of their offshoot's progress. Western Holdings also came in for steady support and rose to 87s. 6d. at one time. Also good were Randfontein (29s.) following further publicity on the recent discussions between South African, Canadian and U.S. authorities on the question of preventing price cutting in uranium when present government contracts expire.

Stillfontein (37s.) began to be noticed in view of the dividend due next month, but there was little interest in other dividend payers. Diamonds tended to be overshadowed by the vagaries of Wall Street and in the circumstances were unaffected by the late Sir Ernest Oppenheimer's encouraging comments on the industry's future in his last annual message to the *Diamond News*.

The copper share market held reasonably steady despite Wall Street and the uncertain metal price. Much of the steadiness resulted from the large bear position in the market—there was little genuine support. Rhodesia-Katanga again provoked speculative interest. The excitement was provided by news that the Kansanshi mine would

be placed on a care and maintenance basis pending the report of the consulting engineers. Rhodesia-Katanga, which had previously fallen from 14s. 6d. to 12s. 9d., promptly fell further to 10s. on receipt of the news and then rallied to a rather uncertain 11s. 9d.; earlier this year they had been up to 54s. 3d. Holders of these shares might as well wait for the engineers' report—there seems to be little point in selling at the moment. At the present price the shares may well be a reasonable long-term copper gamble. The other weak spot in this market was Nchanga which steadily drifted back to 175s.; the interim is due in about a fortnight's time.

The weakness of the forward tin price depressed tin shares for a while, but as the metal price recovered the share market improved in sympathy. Tanjong, however, remained a dull spot at around 14s. 6d. on the continuing decline in their output.

Lead-zincs tended to lose ground, notably Consolidated Zinc (53s. 3d. xd.). Mount Isa, strangely enough, improved further to 26s. 9d. despite their copper commitments and small dividend yield basis. Australian and West African Golds remained fairly steady but showed little inclination to follow when Kaffirs were on the move. The Ghana Government's proposals to institute a new form of taxation which would change the mines' minerals duty to a profits tax and thus allow the companies to benefit substantially from British double-tax relief had little effect on the price of Ashanti at first. Later, on further consideration, Ashanti improved to 13s. 3d.

Commonwealth Government, or an early and substantial recovery in the world price for copper.

The mine and treatment plants are now fully and efficiently equipped; the new crusher and ore transport system are well advanced, and since June, the quantity and grade of ore have been entirely satisfactory.

A matter of interest, and possible importance, is the discovery of a new ore-body adjoining the old North Lyell and Crown Lyell workings, now known as the Corridor anomaly. Some 3,800 ft. of diamond drilling has been done in the area, under an anomaly outlined by the Commonwealth Bureau of Mineral Resources. At present the discovery is considered an interesting prospect, and drilling is being continued.

The discovery is the first new orebody located in the past 50 years. The mine's ore reserve position is strong and operating efficiency is high; the grade in copper and precious metals is low, therefore as the chairman stated, the future depends upon the copper market and upon the assistance that may come from the Australian Government.

Financial News and Results

Kepong Dredging—A Correction.—In a note on Kepong Dredging in this column last week it is regretted that an inaccurate picture of the company's dividend distributions was given. In fact, four distributions have already been made this year, two of 3d. each on the old issued capital of £135,000, and two of 4½d. on the present capital of £81,000, while a final payment of 4½d. is recommended. This compares with an interim of 3d. and a final of 6d. last year.

Sungei Way.—In noting Sungei Way's recommended final dividend of 10 per cent in this column last week, it was not made clear that both this dividend and the interim, also of 10 per cent, were declared on the capital as increased by last year's scrip issue of two-for-one. The 1957 total of 20 per cent is equivalent in cash terms to last year's total of 60 per cent, and was consequently not a reduced distribution.

Dominion Reefs' Earnings Down.—Although working profits of Dominion Reefs in the year ended June 30 last were only slightly lower at £809,797, higher uranium loan repayments have pulled back net earnings from £667,531 in 1956 to £507,351 this year. Dividends paid during the year totalled 2s. 6d. per share (1956: same) absorbing £254,868, and after appropriating £98,054 for capital expenditure £291,042 is carried forward against £136,613 brought in. In his circulated statement, extracts from which appear on this page, Mr. M. E. Rich, the chairman, says that it is intended to raise the throughput to 44,000 tons per month. Meeting, Johannesburg, December 13.

Better Year For Tongkah Harbour Tin.—At £115,638, net taxed profits of Tongkah Harbour Tin Dredging in the year to June 30, 1957, showed a 15 per cent rise over the £99,176 earned in the previous 12 months. Dividends declared during the year totalled 3s. per share, absorbing £92,820, against 2s. 3d. last year. Meeting, Kuala Lumpur, December 11. Sir Douglas Waring is chairman.

Kamunting Earns More—Pays More.—A rise in net profits after tax from £118,956 to £182,200 in the year ended March 31 last enables Kamunting Tin Dredging to recommend a final dividend of 37 per cent. This makes a total of 47 per cent for the year and compares with a single payment of 30 per cent last year. Meeting, London, December 9. Mr. Jack Addinsell is chairman.

Malaysiam E.G.M.—At an extraordinary meeting of Malaysiam Tin held on November 20 resolutions were passed which included one reducing the capital and agreeing the repayment of 1s. per share. This, provided court sanction is received, will make the company's capital £59,550 in 2s. shares.

Meru Tin.—Meru Tin made a loss of £1,770 in the year ended June 30, 1957. This compares with a loss of £887 in 1956, and reduces the carry-forward to £2,313. Meeting, London, December 30.

Tavoy Tin Dredging.—In their report and accounts for the year ended December 31, 1956, Tavoy Tin Dredging, owners of a property in Burma, announce that two of their five dredges had, by the end of the year, been sufficiently reconditioned to produce a small amount of tin concentrates. The remaining three dredges are beyond repair. Loss for the year was £4,817, bringing the total debit balance on profit and loss account to £29,466. Meeting, London, December 16.

Chendai to Liquidate.—Chendai Consolidated are to hold an extraordinary meeting immediately following their annual general meeting on December 21, at which resolutions proposing the winding up of the company will be put. At the date of the last balance sheet (April

30, 1957) net current assets were £10,041, while, since that date, the company's mining leases have been sold for a further £4,025 subject to costs.

Molybdenum For Rio Tinto?—A new company named Pidgeon Molybdenum Mines has been formed by Rio Canadian Exploration in association with Sogemines development to acquire a 12-claim concession in Echo township, near Sioux Lookout, Ontario. Rio has recently completed a geological survey of the property in preparation for a 5,000 ft. drilling programme.

Jos Tin Pays Bonus, Will Make Scrip Issue.—Although profits of Jos Tin Area in the year ended July 31 were marginally lower at £47,860, compared with £51,226 in the preceding period, the dividend of 20 per cent is to be maintained on the capital as increased by last year's one-for-five scrip issue, and a 2 per cent bonus is added to it. In addition, a new scrip issue of one for ten is recommended. Treasury consent has been obtained. The meeting will be held in January.

Anglo's Bid for African and European.—Anglo American's shareholders gave the green light to the creation of an additional 1,500,000 10s. shares (to be issued at the directors' discretion) at an E.G.M. held on November 25. As a result of this, formal details of Anglo's offer to African and European have been announced. The bid, which will remain open from December 3 to January 2, is in the form of a share exchange offer on a basis of one Anglo share for each African and European held, with 60s. in cash for odd shares. It is also announced that applications for the £6,000,000 5½ per cent notes to be issued by the Corporation will be received between December 3 and December 12.

DOMINION REEFS (KLERKSDORP)

MR. M. E. RICH'S STATEMENT

The annual general meeting of Dominion Reefs (Klerksdorp) Ltd., will be held on December 13 at 47, Main Street, Johannesburg.

The following is an extract from the Statement by the Chairman, Mr. M. E. Rich, which has been circulated with the Directors' Report and Accounts for the year ended June 30, 1957:—

The net profit for the year, after allowing for interest on the Uranium Loans and for amortization of the Uranium Project, amounted to £507,351, as compared with £667,531 for the previous year. Of the decrease of £160,180 in the profit for the year, £126,576 is accounted for by the increased amounts provided to cover amortization.

The provision for amortization commenced as from the Certified Date of Full Production, that is, January 1, 1956. Thus the Accounts for the year ended June 30, 1956, included amortization for only six months, amounting to £111,727, whereas the Accounts for the year under review include the charge for the full twelve months, amounting to £238,303.

Revenue from Uranium

Net revenue from Uranium rose from £1,023,388 in 1956 to £1,162,301 for the year ended June 30, 1957, partly as a result of the increase in the production of Uranium Oxide by some 15,000 lbs. Mining and General Expenditure not directly charged against Uranium revenue

increased from £145,946 in 1956, when only 33,490 tons were mined to £294,086 this year when the tonnage mined reached 120,221 tons. As will be seen from the Consulting Engineers' Report, however, the actual cost per ton mined showed a considerable decrease.

Funds appropriated for capital expenditure amounted to £98,054, and Dividends Nos. 9 and 10, together with Non-Resident Shareholders' Tax thereon, absorbed £254,868, leaving £154,429 to be added to the Unappropriated Profits brought forward from last year. The balance of Unappropriated Profits at June 30, 1957, was accordingly increased from £136,613 to £291,042, of which £147,758 is represented by Stores, the balance being the excess of current assets over current liabilities and provisions. It is not our intention to allow this balance of Unappropriated Profit to build up disproportionately over the years but in considering a more liberal dividend policy due regard must naturally be given to our Capital Expenditure requirements and the approaching impact of taxation.

Capital Expenditure

Capital Expenditure during the year amounted to £97,565, as detailed in the Report of the Consulting Engineers, and the estimated Capital Expenditure for the current year will amount to some £110,000, details of which are given in the Statement.

Once the current capital expenditure programme has been completed, future disbursements under this heading should be on a considerably reduced scale. This applies particularly to European housing and imperative improvements to the living conditions of our African labour force, both of which have been major items of expenditure over the past few years.

Over the course of the year mining operations were progressively concentrated in the Bramley Section, but the MacKenzie shaft and equipment were maintained in working order, and had, in fact, to be brought into commission at short notice during August, 1957, when a movement of ground at Bramley adversely affected operations in that section. I should like to pay particular tribute here to the devotion to duty displayed by the mining personnel on that occasion. Operations in the Bramley Section should be restored to normal during the December quarter.

Efforts to Increase Tonnage

As mentioned in the Directors' Report, efforts are at present being directed towards increasing the tonnage from underground, with the intention of raising the Uranium plant throughput to 44,000 tons per month, of which 20,000 tons will be drawn from underground and 24,000 tons from the dump. At this rate of depletion the tonnage available from the dump will be sufficient to last the balance of the 10 year contract period.

We are reasonably confident that the increased rate of feed to the Uranium plant of 44,000 tons per month will be achieved during the quarter ending March, 1958.

CHENDERIANG TIN DREDGING

MR. ADDINSELL'S STATEMENT

The annual general meeting of Chenderiang Tin Dredging Ltd., was held in London on November 22, Mr. J. Addinsell, the chairman, presiding.

The following is from his circulated statement:—The accounts for the year ended March 31, 1957, show a profit of £10,943 after providing £5,400 for taxation, which figure takes into account tax provision in respect of previous years no longer required. An interim dividend of 5 per cent was paid in May last and your directors now recommend a final dividend of 15 per cent, making a total for the year of 20 per cent.

The output was 182 tons against 220 tons for the previous year, the recovery per cubic yard being 0.73 lb. compared with 1.21 lb. The yardage treated was 553,900 cubic yards as against 407,500 cubic yards the previous year and, in spite of the higher rate of wages now in force, the general rise in the cost of stores and materials and heavy expenditure on the retention of tailings, there was a small reduction in the working cost per cubic yard.

The charge for taxation is lower by £17,375 and whilst this partly arises from the lower profit earned it also reflects the new provisions of the Finance Act so far as it relates to Overseas Trading Corporations.

For the period April/September of the current year output was 84½ tons, which compares with 101½ tons for the same period in the previous year.

The report was adopted.

SOUTH AFRICAN TORBANITE MINING AND REFINING (SATMAR)

HIGHER NET PROFIT

The twenty-third Annual General Meeting of South African Torbanite Mining and Refining Company, Ltd., is being held in Johannesburg today. The following is the circulated statement of the chairman, Mr. S. G. Menell, reviewing the period from June 26, 1956, to June 30, 1957:—

During this period the net profit amounted to £117,205 compared with £103,538 last year, following the higher turnover which was attained as a result of the increased supplementation of torbanite oil production with imported crude oil at our refinery, and further improvement in the technique of processing this oil.

Operations

As I indicated to you a year ago, the rate of production of torbanite oil at Ermelo was reduced in September, 1956, and purchases of imported crude oil were increased to maintain an adequate refinery throughput. The higher cost of processing imported crude oil, as compared with torbanite oil, which is principally due to the higher incidence of excise duties on refined products from imported crude, was offset by the larger combined volume processed. During the period the refinery throughput reached the higher level of over 13 million gallons, including the quantity of cracking stock which we continued to pur-

chase from Sasol in accordance with our arrangements with them. Even so, the total capacity of the refinery, which has been extended by improvements in operation, was not fully employed as we were not able to obtain all the crude oil we required on account of railway transport difficulties. However, the Railway Administration is making strenuous efforts to improve the position and I hope that it will not be long before sufficient supplies can be carried to bring the refinery up to full capacity. You will appreciate that the maintenance of supplies of crude oil is a matter of considerable importance to us as the profitability of refining is closely related to the volume processed.

As a result of the policy of refining imported crude oil in addition to torbanite oil and the reduction in the rate of torbanite oil production which has consequently been made possible, the life of our Ermelo mine has been extended, but even on the present reduced scale of mining operations the torbanite deposits now being worked are likely to be exhausted within two or three years' time. Isolated occurrences of high value torbanite and more extensive deposits of lower value torbanite are known to exist elsewhere, but notwithstanding continued intensified exploration we have not as yet been successful in locating additional

LONDON METAL AND ORE PRICES, NOV. 28, 1957

METAL PRICES

Aluminium, 99.5%, £197 per ton	Iridium, £27/29 oz. nom.
Antimony—	Lanthanum (98/99%) 15s. per gram
English (99%) delivered, 10 cwt. and over £190 per ton	Manganese Metal (96%-98%) £310
Crude (70%) £190 per ton	Magnesium, 2s. 5½d. lb.
Ore (60%) basis 20s. 0d./21s. 0d. nom. per unit, c.i.f.	Nickel, 99.5% (home trade) £600 per ton
Arsenic, £400 per ton	Osmium, £20/22 oz. nom.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Osmiridium, nom.
Cadmium 11s. 3d. lb.	Palladium, £7 10s./£8 0s. oz.
Cerium (99% net), £13 18s. lb. delivered U.K.	Platinum U.K. and Empire Refined £30/31 oz.
Chromium, Cr. 99% 7s. 2d. lb.	Imported £27 10s. 0d. nom.
Cobalt, 16s. lb.	Quicksilver, £69 0s. ex-warehouse
Germanium, 99.99%, Ge. kilo lots 3s. 4d. per gram	Rhodium, £42 oz.
Gold, 249s. 3½d.	Ruthenium, £15/£17 oz. nom.
	Selenium, 53s. 6d. per lb.
	Silver, 77½d. f. oz. spot and 77½d. f'd.
	Tellurium, 15s. 16s. lb.

ORES AND OXIDES

Bismuth	30% 5s. 0d. lb. c.i.f.
Chrome Ore—	20% 3s. 3d. lb. c.i.f.
Rhodesian Metallurgical (semifriable) 48%	£19 5s. 0d. per ton c.i.f.
" Hard Lumpy 45%	£19 5s. 0d. per ton c.i.f.
" Refractory 40%	£13 0s. 0d. per ton c.i.f.
" Smalls 44%	£18 0s. 0d. per ton c.i.f.
Baluchistan 48%	£12 0s. 0d. per ton f.o.b.
Columbite, 65% combined oxides, high grade	nom.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% Ca F ₂)	156s. 0d. ex works
Lithium Ore—	
Petalite min. 3½% Li ₂ O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Lepidolite min. 3½% Li ₂ O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Amblygonite basis 7% Li ₂ O	£26 5s. per ton f.o.b. Beira
Magnetite, ground calcined	£28 0s./£30 0s. d/d
Magnetite Raw (ground)	£21 0s./£22 0s. d/d
Manganese Ore Indian	
Europe (46%-48%) basis 95s. freight	124d./125d. per unit c.i.f. nom.
Manganese Ore (43%-45%)	97d. per unit c.i.f. nom.
Manganese Ore (38%-40%)	80d./82d. per unit nom.
Molybdenite (85% basis)	(including duty)
	8s. 5d. nom. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO ₂ (prompt delivery)	£45/£47 per ton c.i.f. Aust'n
Ilmenite 52/54% TiO ₂	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	106s. 0d./111s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 90-95% V ₂ O ₅	£10 per unit c.i.f.
Zircon Sand (Australian) (63-66% ZrO ₂)	£17 per ton c.i.f.

deposits which would be economically exploitable under present conditions and which could be developed in time to maintain continuity of torbanite oil supplies when production at Ermelo ceases.

In order to meet such a situation and bearing in mind the recognized value to the country of this industry, extensive investigations have been undertaken for some time past into the best way of continuing the Company's operations on a profitable basis. Our refinery at Boksburg was designed for the purpose of treating torbanite oil, and is not satisfactorily suited to the processing of naturally occurring crude mineral oil, having regard to the anticipated demand for increasingly higher quality refined products and the advances which have been made in refinery techniques.

As a result of our studies, however, we are satisfied that the Company could continue to operate profitably by refining imported crude oil only, if modernization and expansion of our refinery plant with proved processes were undertaken. It will be appreciated that such a scheme will call for considerable additional capital investment. The position is still under consideration and shareholders will be informed of the Board's recommendations as soon as possible.

The maintenance of the required native labour strength at Ermelo continued to present difficulties, but with the reduced dependence on torbanite oil, labour shortages now have a less serious effect on the overall economy of the Company.

The total production of Satmar petrol was purchased by Sasol Marketing Company, Limited, under our agreement with

them, and all other refined products which we continue to market directly ourselves were satisfactorily disposed of. The demand for our bituminous products has remained strong and the increased output achieved this year was fully absorbed. In spite of the reduced scale of mining operations, the tonnage of coal sold was only slightly less than that for the previous year.

Accounts

Cash resources appear high in relation to our present requirements, but I should mention that during the next few years amounts totalling about £200,000 will be required for the redemption of the outstanding debentures and to meet our obligations in terms of our petrol marketing agreement with the Sasol Marketing Company, Limited. It must also be borne in mind that the purchase of imported crude oil may require a larger amount of finance than is employed under our present arrangements. Until our future plans are clearer, it is desirable to conserve our cash resources, and £30,000 has accordingly been transferred to General Reserve.

The reduction in capital employed in stores stocks has followed from the lower scale of operations at Ermelo and also from the provision of £23,334 against a revaluation in view of the approaching cessation of torbanite oil production.

Capital expenditure during the year amounted to £33,565 most of which was incurred at Boksburg in connection with the processing of imported crude oil and cracking stock from Sasol. The increased provision for amortization and depreciation of fixed assets is considered prudent

in view of the approach of the termination of operations at Ermelo.

You will appreciate that the work involved in investigating and planning for the future change in circumstances is considerable, and I wish to pay tribute to the loyalty and enthusiasm of the Company's employees and the Company's Technical Managers, which has enabled them to undertake this additional task while improving on the financial results from operations during the past year.

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